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## Bad Publicity

Surely it can be assumed that the Government is really serious in its endeavour to rehouse the people of this country, and in this laudable aim it needs the fullest co-operation of everybody concerned. It is well known that one of the limiting factors is the extreme scarcity of builders' castings and there is general agreement that a prime cause of this is the dearth of foundry man-power. The Government, the employers' federations and the trade unions are co-operating wholeheartedly in endeavouring to find a solution to what is admitted to be a difficult problem. The trade unions have produced a quite sensible report, on which we have already commented favourably. A serious mistake, however, has been made in the presentation of this report to the public and thereby a serious disservice has been done to the Government's and the industry's endeavours to overcome the housing shortage. Thus a recent issue of the Manchester "Evening News" appeared with the banner headlines: "35,000 Foundrymen Needed to End Big Hold-up in Housing" and "They Jib at Return to Unhealthy Work." In the various organisations with which we are associated very serious endeavours are made to see that any articles due to appear in the popular Press are duly "vetted" by a responsible official, as the foundry industry is far too complicated to be properly pictured in the limited time available to the editorial staffs.

Serious-minded people should by now realise that it is the habit of the popular Press to stress the abnormal, and we are reasonably certain that the average provincial newspaper would "fall for" a heading reading "Modern Foundry has Cleaner Atmosphere than City Street." This happens to be true, but it is not typical of the industry. Now this case of the Manchester "Evening News" is not an isolated one, and prominent members of the trade unions both in the Midlands and Yorkshire have been guilty of similar indiscretions by direct communication to the Press or by failing to "vet" before publication.

It must be borne in mind that the foundry industry is made up of many thousands of individual establishments and the poorest from the angle of decent working conditions are those owned by enterprising ex-artisans who have set themselves up in business. There is no line of demarkation between the foundry owner and the foundry worker as there is between the colliery proprietor and the miner. Many factors have mitigated against the improvement of working conditions, outstanding amongst which was the law of the land which allowed but a 1 per cent. depreciation on buildings and 5 per cent. on machinery for taxation purposes. A second was price cutting by those insufficiently versed in costing, and a third no sustained demand from the employees. On the grounds of mutual interest we do ask the trade unions to curb the ill-founded enthusiasm of their members for running down their own industry. We seem to remember a story that from an actuarial standpoint the best risk was the life of a country parson and the second a moulder!

The Government are at the moment preparing a film covering the activities of the foundry industry; the employers' federations have produced some interesting booklets, both designed to attract youths, yet for full success, the wholehearted co-operation of the unions is an essential. At their headquarters, this is being given, but there is obviously insufficient control lower down the scale.

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THE NORTH-EASTERN MARINE ENGINEERING COMPANY, LIMITED, have given notice to the Admiralty that they wish to be relieved of their wartime job as manager of Hendon Dock, Sunderland. The firm wish to revert to peace production at their own works. The future of Hendon Dock is being considered by the Admiralty.

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## NEW CATALOGUES

**Barrier Creams.** Innoxa Laboratories, Limited, Balls Pond Road, London, N.1, have sent us an interesting booklet carrying the appropriate title of "The Invisible Glove." It appears that the main object of covering the hands with the barrier cream they manufacture is the prevention of dermatitis, but it is the second objective which makes the main appeal. Thus no matter how dirty—and dirt is not specially related to colour—the hands become during work, if they have been incased in this barrier cream, mere rinsing in water ensures true cleanliness. It seems a particularly attractive proposition for the ironmoulder, where coal dust is incorporated in the sand.

**Fluxes and the Like.** A leaflet received from Foundry Services, Limited, of Long Acre, Nechells, Birmingham, 7, details a number of new preparations they market for the amelioration of foundry materials. Included amongst these is a material in block form which stays at the bottom of the crucible and is used for degassing non-ferrous metals. A second is an exothermic compound for keeping feeder metal liquid for prolonged periods. A new refractory material called "Slix" is announced. It is suitable for making core carriers, oddsides and pattern plates. It is stated to withstand temperatures up to 1,000 deg. C. It is possible that the appearance of the leaflet would have been improved by using a larger and lighter face type for the paragraph headings.

**Cylinder Liners.** The Harold Andrews Grinding Company, Limited, of Bristol Road, Bournbrook, Birmingham, 29, have sent us an interesting, well-illustrated, 32-page catalogue covering the subject of cylinder liners. They are made in two qualities, one a chromium alloy cast iron and the other a nickel-chromium austenitic material, the latter being specially useful where corrosion is encountered. Both brands are made by the centrifugal casting process.

**Welding Screens and Helmets.** A leaflet sent to us by Murex Welding Processes, Limited, of Waltham Cross, Herts, illustrates and describes one model of each. The screen, made of Bakelite, is fitted with both plain and coloured glass, the latter being brought in and out of action at the touch of a lever by the thumb holding the screen. The helmet also carries this gadget.

**Splineshaft Grinding Machines.** Good use of a combination of photography and blue prints has been made by the Churchill Machine Tool Company, Limited, of Broadheath, near Manchester, in a 12-page brochure describing a line (three sizes) of splineshaft grinding machines.

## STEEL FOR LOW-TEMPERATURE EQUIPMENT

In connection with hydrocarbon research at a plant in Carthage, Texas, a certain phase calls for equipment that will operate at a temperature of minus 300 deg. F., and for this purpose an 8.5 per cent. nickel pearlitic steel has been developed by a research group, including Lukens Steel Company, Babcock & Wilcox Tube Company and the International Nickel Company.

## CORRESPONDENCE

*[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]*

### NORTH-EAST ENGINEERING BUREAU

*To the Editor of* THE FOUNDRY TRADE JOURNAL.

SIR,—My attention has been drawn to an article appearing in the January 24 issue of your Journal, entitled "Some Thoughts on Foundry Management," by J. R. Roxburgh, in which he makes reference to the fact that "53 companies decided at Newcastle-upon-Tyne to form a North-East Engineering Bureau at a cost of £4,500 per year to train apprentices to form a nucleus of engineers skilled in scientific production and management."

I much regret that this misleading statement should have appeared in your Journal. This reference indicates that the North-East Engineering Bureau has been inaugurated for the sole purpose of training apprentices, which is not the case. Would you, therefore, please be good enough to correct this impression by stating the full aims and objects of the Bureau, which are as follow. The North-East Engineering Bureau was inaugurated 12 months ago for the sole purpose of developing and expanding a light engineering industry in the North-East, thereby maintaining, as far as possible, full employment within the area. The organisation comprises over 100 firms (not 53) representing 80 per cent. of the employees of the engineering industry of the North-East. The functions of the Bureau are manifold, but one of its aims is to train apprentices who will ultimately become the executives of the future. They will be given a special practical training in conjunction with a part-time theoretical course at the local technical colleges, and on completion of this course they will receive further training in scientific production and management.

To substantiate the above I have pleasure in enclosing a copy of our rules and constitution, together with a copy of our annual report.

Yours, etc.,
F. GIBBONS,
General Manager.

The Guildhall,
Newcastle-upon-Tyne, 1.
February 2, 1946.

## ALUMINIUM AND ITS ALLOYS

Many new specifications covering aluminium and its alloys have been issued during recent years, so the British Aluminium Company, Limited, Salisbury House, London Wall, W.C.2, have assembled all current specifications issued by the British Standards Institution and the various Government departments, in a publication entitled "Standard Specifications for Aluminium and Aluminium Alloys." These cover notched bars and ingots, rolling slabs and billets; casting alloys; bars for machining and extruded sections; forging bars; forgings; tubes; wire, welding rod and rivets, sheets and strip. The publication forms a useful reference for those engaged in the manufacture and use of aluminium and aluminium alloys.

# THE GASSING OF BRONZES BY REACTION WITH MOULDING AND CORE SANDS

By W. T. PELL-WALPOLE, B.Sc., Ph.D.

(*Continued from page* 150.)

**Effect of Variation in Concentration of the Bonding Agent**

These tests were made with the red sand only. Results are shown in full in Table IX, and the gassing values $P_D$ and $P_W$ respectively are plotted against concentration in Figs. 8 and 9. If the only factor affecting the degree of gassing were the relative proportions of sand and bonding agent in a given mixture, then the curves for $P_D$ would be expected to be straight lines joining the values of the pure materials. The departure of the observed values from the linear relation is due to the effect of the various bonding additions on the permeability of the sand. If the observed curve lies below the linear position, as is the case with all the cereal bonds, then the permeability of the sand is increased to such an extent that much of the water vapour liberated on heating by contact with the molten bronze escapes via the sand, instead of reacting with the bronze to produce hydrogen porosity. If, on the other hand, the curve lies above the linear position, *i.e.*, convex upwards as for the aluminous cement mixtures, then the permeability of the mixtures is lower than that of the sand. The curve for pure colloidal clay mixtures departs very slightly from the linear except at very low concentrations, indicating that this addition has little effect on the permeability of the red sand.

The curves for $P_W$ are very similar to those of $P_D$ for the clay-bonded mixtures, but with the cereal bonds there is a marked difference, the $P_W$ curves being much more nearly horizontal. This is due to the much higher proportion of water absorbed by the high cereal content mixtures to give a loam of the consistency required for lining the test-pot. A unit weight of such a loam contains a low proportion of the solids, and since it is only the combined water of the solids which affects gassing (the free water is driven off during baking) the porosity produced by unit weight of the loam ($P_W$) is obviously much lower than that produced by an equal weight of the dried mixture ($P_D$).

It should be noted that all the bonding agents examined except pure colloidal clay and commercial starch product give

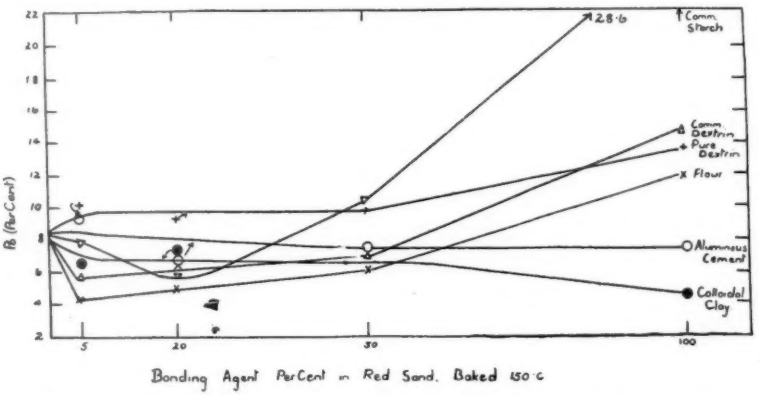


FIG. 8.—EFFECT OF CONCENTRATION OF BOND ON $P_D$ VALUE FOR RED SAND.

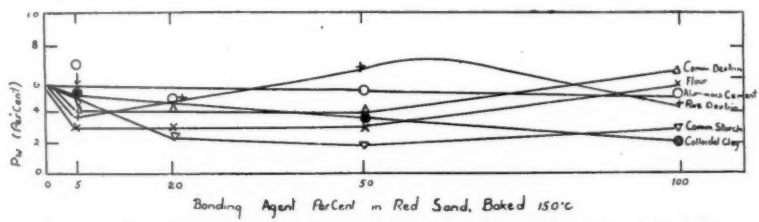


FIG. 9.—EFFECT OF CONCENTRATION OF BOND ON $P_W$ VALUE FOR RED SAND.

## The Gassing of Bronzes

the least gassing when present in low concentration, generally 5 per cent., and with the two bonding agents mentioned the further decrease at higher concentrations is only slight.

### Effect of the Total Quantity of Bonded Sand in Contact with the Molten Bronze

The effect of the quantity of sand on the extent of gassing produced in the bronze was investigated for the red sand bonded with the commercial starch agent and red sand bonded with pure colloidal clay. The results (Table X, and Fig. 7) show that there is an approximate

TABLE IX.—*The Effect of Concentration of the Bonding Agent on the Gassing Action of Red Sand. All mixtures baked at 150 deg. C.*

| Bonding Addition. | Wet Wt. Grm. | Dry Wt. Grm. | Visual Signs of Gas Porosity. | Observed Densities. | | | | Tensile Properties. | | | | Gassing Index. | | Analysis. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Upper T.P. | | Lower T.P. | | | | | |
| | | | | Head. | 1½ in. Bar. | Upper T.P. | Lower T.P. | U.T.S. | El. Per cent. | U.T.S. | El. Per cent. | $P_W$. | $P_D$. | Sn Per cent. | P Per cent. |
| Pure colloidal clay— | | | | | | | | | | | | | | | |
| 5 per cent. .. .. | 88 | 60 | Very severe | 8.36 | 8.50 | 8.45 | 8.58 | 20.4 | 2 | 22.1 | 14 | 4.7 | 6.6 | 9.6 | 0.67 |
| 20 ,, .. .. | 84 | 57 | ,, | 8.32 | 8.56 | 8.49 | 8.61 | 19.1 | 9 | 23.6 | 14 | 4.7 | 6.9 | 10.0 | 0.68 |
| 50 ,, .. .. | 82 | 41 | Severe .. | 8.42 | 8.62 | 8.59 | 8.65 | 25.4 | 22 | 23.6 | 17 | 3.5 | 7.0 | 9.7 | 0.71 |
| Aluminous cement— | | | | | | | | | | | | | | | |
| 5 per cent. .. .. | 79 | 58 | Very severe | 8.34 | 8.34 | 8.31 | 8.40 | 15.3 | 3 | 18.5 | 3 | 6.9 | 9.4 | 9.7 | 0.71 |
| 20 ,, .. .. | 100 | 69 | ,, | 8.27 | 8.40 | 8.33 | 8.46 | 17.6 | 5 | 19.4 | 8 | 4.5 | 6.5 | 9.7 | 0.70 |
| 50 ,, .. .. | 91 | 60 | ,, | 8.23 | 8.41 | 8.40 | 8.46 | 19.2 | 8 | 20.6 | 11 | 4.9 | 7.4 | 9.7 | 0.70 |
| Flour— | | | | | | | | | | | | | | | |
| 5 per cent. .. .. | 90 | 60 | Moderate .. | 8.49 | 8.63 | 8.54 | 8.61 | 24.1 | 17 | 22.6 | 12 | 2.9 | 4.4 | 9.7 | 0.69 |
| 20 ,, .. .. | 76 | 42 | ,, .. | 8.58 | 8.65 | 8.64 | 8.62 | 23.9 | 15 | 23.0 | 12 | 2.8 | 5.1 | 9.7 | 0.65 |
| 50 ,, .. .. | 81 | 40 | ,, .. | 8.51 | 8.62 | 8.57 | 8.60 | 24.5 | 20 | 23.7 | 14 | 3.1 | 6.2 | 9.9 | 0.69 |
| Pure dextrin— | | | | | | | | | | | | | | | |
| 5 per cent. .. .. | 125 | 90 | Severe .. | 8.40 | 8.46 | 8.45 | 8.47 | 22.2 | 16 | 19.0 | 6 | 3.4 | 4.8 | 10.1 | 0.70 |
| 20 ,, .. .. | 84 | 57 | Very severe | 8.32 | 8.56 | 8.49 | 8.61 | 19.1 | 9 | 23.6 | 14 | 4.6 | 6.9 | 9.4 | 0.68 |
| 50 ,, .. .. | 64 | 42 | Moderate .. | 8.55 | 8.42 | — | 8.43 | — | — | 17.4 | 6 | 6.6 | 9.9 | 9.9 | 0.72 |
| Commercial dextrin— | | | | | | | | | | | | | | | |
| 5 per cent. .. .. | 84 | 60 | Severe .. | 8.43 | 8.55 | 8.52 | 8.56 | 24.1 | 15 | 22.0 | 12 | 4.1 | 5.7 | 10.0 | 0.68 |
| 20 ,, .. .. | 84 | 57 | Moderate .. | 8.52 | 8.49 | 8.48 | 8.50 | 17.2 | 11 | 17.5 | 9 | 4.3 | 6.3 | 10.1 | 0.63 |
| 50 ,, .. .. | 68 | 39 | Slight .. | 8.59 | 8.58 | 8.61 | 8.60 | 22.6 | 12 | 22.0 | 12 | 4.0 | 7.0 | 9.8 | 0.67 |
| Commercial starch— | | | | | | | | | | | | | | | |
| 5 per cent. .. .. | 85 | 46 | Moderate .. | 8.50 | 8.60 | 8.61 | 8.62 | 25.5 | 22 | 24.5 | 19 | 4.3 | 8.0 | 10.0 | 0.70 |
| 20 ,, .. .. | 85 | 26 | Slight .. | 8.64 | 8.65 | 8.71 | 8.71 | 25.4 | 23 | 23.7 | 16 | 2.3 | 6.9 | 10.0 | 0.72 |
| 50 ,, .. .. | 84 | 13 | Very slight | 8.67 | 8.69 | 8.68 | 8.69 | 25.9 | 21 | 25.5 | 21 | 1.7 | 10.2 | 10.0 | 0.72 |
| Gum— | | | | | | | | | | | | | | | |
| 5 per cent. .. .. | 85 | 57 | Very severe | 8.37 | 8.41 | 8.39 | 8.45 | 18.0 | 5 | 20.0 | 7 | 5.6 | 8.5 | 9.6 | 0.69 |
| 20 ,, .. .. | 63 | 42 | ,, | 8.27 | 8.47 | 8.40 | 8.55 | 18.8 | 7 | 21.4 | 10 | 7.1 | 10.6 | 9.6 | 0.68 |
| 50 ,, .. .. | 32 | 22 | ,, | 8.43 | 8.18 | 8.05 | 8.31 | 15.3 | 3 | 18.0 | 4 | 18.0 | 22.0 | 9.7 | 0.71 |

TABLE X.—*The Effect of Quantity of Sand Reacting on the Extent of Porosity Produced. (All materials baked at 150 deg. C.)*

| Material Tested. | Wet Wt. Grm. | Dry Wt. Grm. | Visual Signs of Gas Porosity. | Observed Densities. | | | | Bulk Porosity Per cent. | Tensile Properties. | | | | Gassing Index. | | Analysis. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Upper T.P. | | Lower T.P. | | | | | |
| | | | | Head. | 1½ in. Bar. | Upper T.P. | Lower T.P. | | U.T.S. | El. Per cent. | U.T.S. | El. Per cent. | $P_W$. | $P_D$. | Sn Per cent. | P Per cent. |
| Red sand plus 20 per cent. commercial starch .. | 137 | 46 | Moderate .. | 8.56 | 8.50 | 8.49 | 8.53 | 3.4 | 17.1 | 5 | 20.3 | 7 | 2.5 | 7.5 | 10.2 | 0.72 |
| Ditto .. .. | 85 | 26 | Slight .. | 8.64 | 8.65 | 8.71 | 8.71 | 1.9 | 25.4 | 23 | 23.7 | 16 | 2.3 | 6.9 | 10.2 | 0.58 |
| Ditto .. .. | 36 | 10 | None .. | 8.72 | 8.73 | 8.72 | 8.76 | 1.0 | 25.3 | 13 | 24.2 | 17 | 2.8 | 10.0 | 9.8 | 0.68 |
| Commercial starch .. | 82 | 7.5 | Moderate .. | 8.61 | 8.57 | 8.58 | 8.57 | 2.7 | 23.5 | 12 | 20.8 | 10 | 3.3 | 36.0 | 9.8 | 0.72 |
| Ditto .. | 53 | 6 | Slight .. | 8.57 | 8.65 | 8.64 | 8.65 | 2.1 | 22.4 | 16 | 21.9 | 9 | 3.9 | 35.0 | 10.0 | 0.76 |
| Red sand plus 5 per cent. pure colloidal clay.. | 88 | 62 | Very severe | 8.36 | 8.50 | 8.50 | 8.50 | 4.0 | 20.4 | 2 | 22.1 | 14 | 4.5 | 6.3 | 9.6 | 0.67 |
| Ditto .. .. | 200 | 148 | ,, | 8.05 | 8.24 | 8.06 | 8.37 | 7.2 | 11.2 | 2 | 18.4 | 5 | 3.6 | 5.4 | 10.1 | 0.71 |
| Aluminous cement, 100 per cent. .. .. | 73 | 49 | Severe .. | 8.52 | 8.50 | 8.42 | 8.59 | 3.6 | 17.0 | 3 | 20.0 | 9 | 4.9 | 7.3 | 9.7 | 0.70 |
| Ditto .. .. | 62 | 38 | ,, .. | 8.48 | 8.56 | 8.55 | 8.59 | 3.2 | 25.0 | 18 | 23.9 | 14 | 5.1 | 8.4 | 9.9 | 0.77 |

linear relation between the quantity of sand involved in the reaction and the degree of porosity produced in the bronze. In casting practice the quantity of sand reacting would probably be proportional to the area of the sand/metal interface, since the sand would only be heated to a limited depth from the surface.

### Effect of Sand Baking Conditions

(*a*) *Baking Temperature.*—The effect of variation of baking temperature on the degree of gas porosity produced by reaction was studied for a number of bonding agents, and bonded sands. Organic bonding agents, whether tested independently or admixed with sand, could not be baked above 200 deg. C., since at higher temperatures these substances char and lose their bonding properties. Clays or clay-bonded sands can be baked at much higher temperatures, and one bond, aluminous cement, typical of this group, was tested up to 900 deg. C. The results of these tests are shown in Table XI and Fig. 10.

The extent of gas porosity produced by the reaction on pouring, diminishes markedly with increase of baking temperature for all bonding agents, presumably due to an accompanying decrease in the amount of combined water retained. With the clay bond complete absence of gassing is obtained only by baking at bright red heat, 800 to 900 deg. C. (see Fig. 10). Such

TABLE XI.—*The Effect of Baking Temperature of Sands or Bonding Agents on the Gas Porosity Produced by Reaction with Molten Bronze.*

| Material Tested. | Wet Wt. Grm. | Dry Wt. Grm. | Baking Temp. deg. C. | Visual Signs of Gas Porosity. | Observed Densities. | | | | Tensile Properties. | | | | Gassing Index. | | Analysis. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Upper T.P. | | Lower T.P. | | | | | |
| | | | | | Head. | 1½ in. Bar. | Upper T.P. | Lower T.P. | U.T.S. | El. Per cent. | U.T.S. | El. Per cent. | Pw. | Pd. | Sn Per cent. | P Per cent. |
| Red sand, 100 per cent. | 85 | 57 | 150 | Severe | 8.25 | 8.45 | 8.40 | 8.38 | 20.1 | 9 | 21.0 | 12 | 5.6 | 8.4 | 9.5 | 0.69 |
| Ditto | 83 | 62 | 300 | Moderate | 8.34 | 8.56 | 8.51 | 8.61 | 23.8 | 12 | 24.2 | 14 | 4.2 | 5.6 | 9.9 | 0.76 |
| Aluminous cement, 100 per cent. | 73 | 49 | 150 | Severe | 8.52 | 8.50 | 8.42 | 8.54 | 17.0 | 3 | 20.4 | 9 | 5.0 | 7.5 | 9.7 | 0.70 |
| Ditto | 89 | 60 | 300 | Moderate | 8.40 | 8.61 | 8.52 | 8.62 | 20.0 | 12 | 23.8 | 17 | 3.3 | 5.0 | 10.0 | 0.75 |
| Ditto | 99 | 66 | 600 | Slight | — | 8.72 | 8.72 | 8.72 | 26.5 | 22 | 23.8 | 14 | 1.2 | 1.8 | — | — |
| Ditto | 73 | 49 | 900 | None | 8.73 | 8.74 | 8.80 | 8.75 | 26.5 | 20 | 24.5 | 14 | 1.2 | 1.8 | 9.6 | 0.72 |
| Red sand plus 5 per cent. aluminous cement | 79 | 58 | 150 | Very severe | 8.34 | 8.34 | 8.31 | 8.60 | 15.3 | 3 | 18.5 | 3 | 6.9 | 9.4 | 9.9 | 0.70 |
| | 83 | 61 | 300 | Severe | 8.41 | 8.46 | 8.39 | 8.56 | 22.4 | 12 | 16.8 | 5 | 5.1 | 6.8 | 10.1 | 0.74 |
| Sea sand plus 10 per cent. aluminous cement | 80 | 59 | 150 | Moderate | 8.57 | 8.58 | 8.57 | 8.58 | 24.9 | 10 | 22.4 | 9 | 3.4 | 4.4 | 10.0 | 0.77 |
| | 92 | 68 | 300 | ,, | 8.60 | 8.63 | 8.60 | 8.62 | 26.3 | 21 | 23.8 | 11 | 2.5 | 3.7 | 10.3 | 0.75 |
| Pure colloidal clay, 100 per cent. | 55 | 25 | 150 | Slight | 8.69 | 8.74 | 8.74 | 8.74 | 27.5 | 30 | 27.2 | 29 | 1.9 | 4.2 | 9.8 | 0.77 |
| | 51 | 26 | 300 | Very slight | 8.70 | 8.73 | 8.73 | 8.73 | 25.9 | 20 | 24.8 | 17 | 2.2 | 4.4 | 9.9 | 0.76 |
| Red sand plus 5 per cent. pure colloidal clay | 88 | 59 | 150 | Severe | 8.36 | 8.50 | 8.45 | 8.58 | 20.4 | 2 | 22.1 | 14 | 4.5 | 6.3 | 9.6 | 0.67 |
| | 90 | 64 | 300 | Moderate | 8.49 | 8.62 | 8.53 | 8.69 | 22.8 | 8 | 23.6 | 15 | 2.9 | 4.1 | 10.3 | 0.74 |
| Sea sand plus 10 per cent. pure colloidal clay | 90 | 67 | 150 | Moderate | 8.49 | 8.55 | 8.57 | 8.61 | 25.1 | 28 | 23.2 | 15 | 3.5 | 4.7 | 9.9 | 0.70 |
| | 84 | 63 | 300 | ,, | 8.54 | 8.67 | 8.65 | 8.68 | 23.6 | 14 | 27.0 | 28 | 2.4 | 3.2 | 10.0 | 0.76 |
| Fireclay, 100 per cent. | 91 | 57 | 150 | Severe | 8.41 | 8.56 | — | 8.69 | — | — | 22.0 | 12 | 3.7 | 5.9 | 9.9 | 0.70 |
| Ditto | 92 | 63 | 300 | ,, | 8.41 | 8.48 | 8.42 | 8.55 | 18.0 | 6 | 22.4 | 12 | 4.4 | 6.6 | 10.0 | 0.70 |
| Limonite, 100 per cent. | 40 | 25 | 150 | Moderate | 8.52 | 8.68 | 8.66 | 8.70 | 26.2 | 22 | 25.2 | 19 | 5.1 | 8.1 | 10.0 | 0.66 |
| Ditto | 53 | 38 | 300 | ,, | 8.59 | 8.63 | 8.61 | 8.61 | 25.6 | 21 | 25.2 | 22 | 4.3 | 6.0 | 10.1 | 0.71 |
| Sea sand plus 10 per cent. limonite | 49 | 35 | 150 | Slight | 8.62 | 8.67 | 8.68 | 8.67 | 26.4 | 20 | 24.8 | 17 | 3.7 | 5.0 | 9.8 | 0.79 |
| | 83 | 62 | 300 | Moderate | 8.50 | 8.62 | 8.65 | 8.73 | 24.4 | 16 | 23.1 | 13 | 3.1 | 4.2 | 10.0 | 0.74 |
| Red sand plus 5 per cent. flour | 79 | 39 | 150 | Slight | 8.58 | 8.65 | 8.64 | 8.62 | 23.9 | 15 | 23.5 | 12 | 2.7 | 5.5 | 9.7 | 0.65 |
| Ditto | 91 | 61 | 200 | ,, | 8.54 | 8.62 | 8.62 | 8.65 | 26.3 | 23 | 24.1 | 15 | 2.7 | 4.0 | 9.9 | 0.74 |
| Sea sand plus 20 per cent. flour | 87 | 58 | 150 | Severe | 8.47 | 8.51 | 8.55 | 8.55 | 22.6 | 11 | 24.7 | 19 | 4.2 | 6.3 | 9.8 | 0.79 |
| Ditto | 100 | 67 | 200 | Moderate | 8.57 | 8.63 | 8.62 | 8.63 | 25.9 | 22 | 25.7 | 21 | 2.0 | 3.0 | 10.0 | 0.74 |
| Red sand plus 5 per cent. pure dextrin | 125 | 89 | 150 | Severe | 8.40 | 8.50 | 8.45 | 8.47 | 22.6 | 16 | 19.0 | 6 | 3.1 | 4.4 | 10.1 | 0.70 |
| | 92 | 65 | 200 | Slight | 8.49 | 8.64 | 8.58 | 8.67 | 25.0 | 20 | 24.1 | 14 | 2.7 | 3.8 | 9.9 | 0.75 |
| Red sand plus 5 per cent. commercial dextrin | 84 | 59 | 150 | Severe | 8.43 | 8.55 | 8.52 | 8.58 | 24.1 | 15 | 22.0 | 12 | 3.9 | 5.6 | 10.0 | 0.68 |
| | 90 | 64 | 200 | Slight | 8.61 | 8.60 | 8.60 | 8.65 | 24.4 | 18 | 25.2 | 22 | 2.8 | 3.9 | 9.9 | 0.75 |
| Sea sand plus 20 per cent. commercial dextrin | 76 | 59 | 150 | Moderate | 8.49 | 8.60 | — | 8.60 | — | — | 22.8 | 10 | 3.7 | 4.8 | 10.0 | 0.76 |
| | 85 | 60 | 200 | Very slight | 8.72 | 8.66 | 8.70 | 8.65 | 26.2 | 21 | 24.8 | 15 | 2.0 | 2.8 | 9.9 | 0.74 |
| Red sand plus 5 per cent. commercial starch | 84 | 46 | 150 | Moderate | 8.50 | 8.60 | 8.61 | 8.62 | 25.5 | 22 | 24.5 | 19 | 3.2 | 5.8 | | |
| | 73 | 43 | 200 | Slight | 8.62 | 8.62 | 8.62 | 8.63 | 24.4 | 15 | 22.7 | 14 | 3.1 | 5.3 | 10.1 | 0.75 |
| Sea sand plus 20 per cent. commercial starch | 106 | 44 | 150 | Moderate | 8.57 | 8.56 | 8.57 | 8.58 | 25.4 | 20 | 23.8 | 15 | 2.8 | 6.7 | 10.0 | 0.77 |
| | 91 | 35 | 200 | Slight | 8.65 | 8.67 | 8.68 | 8.69 | 26.8 | 24 | 22.7 | 21 | 1.9 | 4.8 | 10.0 | 0.74 |

## The Gassing of Bronzes

a procedure would be impracticable and costly for normal production, and better results are likely to be obtained by using one of the least gassing types of bonding agent and baking at 300 deg. C. for clay-bonded or 200 deg. C. for cereal or oil-bonded mixtures.

(*b*) *Baking Time.*—The standard baking time used in the preceding tests was ¼ hr., but extension of this

TABLE XII.—*Effect of Time of Baking at 150 deg. C. on the Gassing Action of Sands.*

| Material Tested. | Wet Wt. Grm. | Dry Wt. Grm. | Baking Time. Hr. | Visual Signs of Gas Porosity. | Observed Densities. | | | | Tensile Properties. | | | | Gassing Index. | | Analysis. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Upper T.P. | | Lower T.P. | | | | | |
| | | | | | Head. | 1½ in. Bar. | Upper T.P. | Lower T.P. | U.T.S. | El. Per cent. | U.T.S. | El. Per cent. | $P_W$. | $P_D$. | Sn Per cent. | P Per cent. |
| Red sand, 100 per cent. .. .. | 88 | 58 | ¼ | Severe .. | 8.40 | 8.28 | 8.29 | 8.27 | 16.8 | 4 | 14.5 | 2 | 6.6 | 10.0 | 9.8 | 0.78 |
| Ditto .. .. | 85 | 57 | 4 | Severe .. | 8.31 | 8.39 | 8.24 | 8.45 | 16.0 | 4 | 18.8 | 6 | 5.9 | 8.8 | 10.2 | 0.78 |
| Red sand plus 5 per cent. commercial starch .. | 84 | 46 | ¼ | Moderate .. | 8.50 | 8.60 | 8.61 | 8.62 | 25.5 | 22 | 24.5 | 19 | 3.2 | 5.8 | 10.0 | 0.70 |
| Ditto .. .. | 84 | 46 | 4 | Moderate .. | 8.56 | 8.54 | 8.56 | 8.55 | 25.6 | 16 | 23.2 | 13 | 3.5 | 6.4 | 9.9 | 0.81 |

TABLE XIII.—*Effect of Air Circulation during Baking on Gassing of* 2B8 *Bronze by Bonded Sand Mixtures.*

| Ingot Ref. No. | Sand Mixture. | Baking Conditions.* | Wt. Wet. | Wt. Dry. | Pouring Rate, lb./min. | Pouring Temp., deg. C. | Density. | | | | Tensile Test. | | | | Gassing Index. | | Analysis. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Upper. | | Lower. | | | | | |
| | | | | | | | Head. | 1½ in. Bar. | Upper T.P. | Lower T.P. | U.T.S. | El. Per Cent. | U.T.S | El. Per Cent. | $P_W$. | $P_D$. | Sn Per Cent. | P Co |
| 186 | Red sand plus 5 per cent. aluminous cement .. | 1. ¼ hr. 300° C. | 90 | 60 | 8 | 1,200 | 8.09 | 7.90 | 8.06 | — | 9.9 | 1 | — | — | 11.0 | 16.5 | 9.9 | 0. |
| 187 | Ditto .. | Ditto .. | 85 | 57 | 8 | 1,225 | 7.90 | 8.00 | 8.19 | 8.15 | 9.6 | 3 | 12.2 | 2 | 11.0 | 16.5 | 9.7 | 0. |
| 253 | Ditto .. | 0. ¼ hr. 300° C. | 83 | 62 | 8 | 1,250 | 8.41 | 8.46 | 8.39 | 8.56 | 22.4 | 12 | 16.8 | 5 | 5.1 | 6.8 | 10.1 | 0. |
| 188 | Aluminous cement only | 1. ,, ,, | 80 | 53 | 8 | 1,225 | 7.90 | 7.95 | 7.86 | 7.96 | 9.4 | 3 | 11.2 | 5 | 12.5 | 18.7 | 10.0 | 0. |
| 189 | Ditto .. | 1. 4 hr. ,, | 80 | 53 | 8 | 1,225 | 8.21 | 8.17 | — | 8.16 | — | — | 12.2 | 3 | 9.1 | 13.6 | 9.8 | 0. |
| 233 | Ditto .. | 0. ¼ hr. ,, | 89 | 59 | 8 | 1,250 | 8.40 | 8.61 | 8.52 | 8.62 | 20.0 | 12 | 23.8 | 17 | 3.3 | 4.9 | 10.0 | 0. |
| 190 | Red sand plus 5 per cent. pure colloidal clay .. | 1. ,, ,, | 80 | 53 | 8 | 1,225 | 8.10 | 8.30 | 8.18 | 8.45 | 15.4 | 2 | 16.6 | 3 | 8.1 | 12.1 | 9.9 | 0. |
| 258 | Ditto .. | 0. ,, ,, | 90 | 64 | 8 | 1,250 | 8.49 | 8.62 | 8.53 | 8.69 | 22.2 | 8 | 23.6 | 15 | 2.9 | 4.1 | 10.3 | 0. |
| 191 | Red sand alone | 1. ,, ,, | 88 | 63 | 8 | 1,225 | 8.31 | 8.41 | 8.21 | 8.51 | 12.4 | 2 | 20.4 | 7 | 5.6 | 7.8 | 9.9 | 0. |
| 252 | Ditto .. | 0. ,, ,, | 83 | 61 | 8 | 1,250 | 8.41 | 8.56 | 8.51 | 8.62 | 23.8 | 12 | 24.2 | 14 | 4.1 | 5.1 | 9.9 | 0. |
| 196 | Red sand plus 5 per cent. commercial starch .. | 1. ,, 150° C. | 84 | 42 | 8 | 1,250 | 8.05 | 8.10 | 8.08 | 8.06 | 19.6 | 5 | 19.6 | 5 | 9.9 | 19.8 | 9.8 | 0. |
| 154 | Ditto .. | 0. ,, ,, | 84 | 46 | 8 | 1,250 | 8.56 | 8.64 | 8.67 | 8.69 | 25.0 | 23 | 24.5 | 19 | 4.1 | 7.5 | 9.8 | 0. |
| 197 | Sea sand plus 10 per cent. commercial starch .. | 1. ,, ,, | 80 | 47 | 16 | 1,225 | 8.24 | 8.49 | 8.35 | 8.57 | 16.4 | 5 | 20.0 | 5 | 5.5 | 9.3 | 10.1 | 0. |
| 210 | Ditto .. | 0. ,, ,, | 82 | 41 | 16 | 1,250 | 8.45 | 8.62 | 8.59 | 8.62 | 22.5 | 8 | 20.4 | 7 | 3.3 | 6.6 | 10.3 | 0. |
| 195 | Sea sand plus 10 per cent. flour.. .. | 1. ,, ,, | 81 | 54 | 16 | 1,250 | 8.32 | 8.51 | 8.44 | 8.51 | 20.0 | 7 | 19.0 | 6 | 5.0 | 7.5 | 9.8 | 0. |
| 205 | Ditto .. | 0. ,, ,, | 84 | 56 | 16 | 1,250 | 8.43 | 8.48 | 8.49 | 8.42 | 21.6 | 8 | 18.8 | 5 | 4.7 | 7.0 | 10.1 | 0. |
| 198 | Sea sand plus 10 per cent. commercial dextrin .. | 1. ,, ,, | 91 | 67 | 16 | 1,220 | 8.17 | 8.38 | 8.32 | 8.36 | 18.4 | 5 | 17.6 | 4 | 6.1 | 8.2 | 10.0 | 0. |
| 204 | Ditto .. | 0. ,, ,, | 81 | 60 | 16 | 1,250 | 8.47 | 8.52 | 8.52 | 8.52 | 19.6 | 4 | 18.8 | 5 | 4.4 | 5.9 | 10.3 | 0. |
| 199 | Sea sand plus 10 per cent. pure colloidal clay .. | 0. ,, ,, | 87 | 64 | 16 | 1,200 | 8.43 | 8.56 | 8.53 | 8.56 | 19.6 | 5 | 19.6 | 5 | 3.8 | 5.2 | 10.1 | 0. |
| 207 | Ditto .. | 1. ,, ,, | 85 | 63 | 16 | 1,250 | 8.30 | 8.43 | 8.34 | 8.47 | 14.8 | 2 | 20.7 | 7 | 5.6 | 7.6 | 10.0 | 0. |

* *Baking conditions* : 1. = Funnel pot inverted ; limited access of air.
0. = ,, ,, dried open to circulating air.

time to 4 hr. both for red sand alone and red sand with a cereal bond produced no difference in the extent of porosity in the bronze (Table XII). Thus the equilibrium value of the combined water content for a given temperature must be attained very rapidly with the free air circulation used in these baking tests.

(c) *Air Circulation during Baking.*—Baking was normally carried out with the inside of the lined pot exposed to the warm air circulating in the gas-heated baking oven. A number of extra tests were made with the lined pot inverted so that only very limited access of air was possible. The results (Table XIII) show in

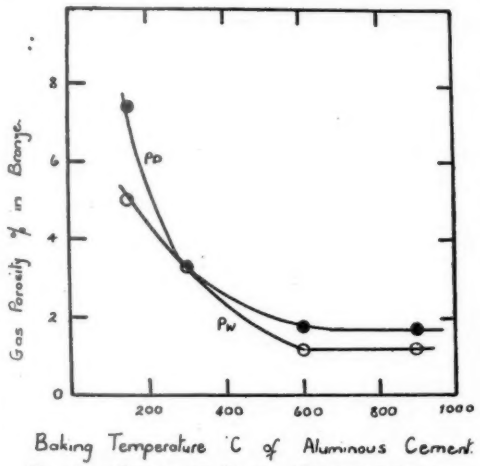


FIG. 10.—EFFECT OF BAKING TEMPERATURE ON GASSING ACTION OF ALUMINOUS CEMENT.

all cases a severe increase of gassing compared with corresponding tests with open baking irrespective of baking time. Probably the water-vapour content of the air in contact with the lining remained too high to permit the normal dehydration to occur, so that even with prolonged baking the residual combined water content of the sand mixtures never fell to the equilibrium value for the temperature. These results indicate the great importance of ensuring free air circulation for the making of sand moulds, cores, pouring bowls, runner bushes, etc.

(*To be continued.*)

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AN EXHIBITION OF scientific and engineering inspection equipment is being held in the Northumberland Road Drill Hall, Newcastle-upon-Tyne, from Tuesday last until February 22. The purpose of the exhibition is mainly educational. Demonstrations of the use of the equipment will be given, and there will be lectures on certain scientific instruments and inspection methods almost every day.

# SHORT PAPERS ON PATTERNMAKING

## BIRMINGHAM BRANCH DISCUSSION

*Discussion on two short Papers presented to the Birmingham, Coventry and West Midlands branch of the Institute of British Foundrymen, Mr. A. J. Shore presiding. "Pattern Blocks for Small-scale Production," by Mr. S. Yates, was printed in our issue of January 31, and "Pattern-making for Small Batch, Machine Moulded Castings," by Mr. A. G. Squires, appeared in our issue of January 10.*

In reply to questions by members, MR. YATES said the most important thing was to get the pattern on the plate accurately. When he referred to the moulder being consulted he meant the moulder in charge of the job. The foundry manager should also be consulted. It was easy to drill the pattern because they had the side to build up to. When they came to the reverse side of the pattern the difficulty arose. It must be set exactly level to get the hole at right-angles, and that was why he said it was best to drill the plate first. His idea of limited production was in the region of a gross of castings. There was always the possibility of repeat orders, and in any case the pattern had to go into the stores. He had in mind upwards of a gross of castings. The thickness of the pattern block was only about ⅛ in., and the back of the frame was filled in with cement.

Soft alloy patterns had been used on "jaw" machines, and if the number of castings was limited to a gross they would stand it. For high production in such a machine a solid alloy casting was necessary. The contraction of a soft alloy pattern was not serious. They took the precaution of making the frame with a series of dovetailed cores on the inside which completely stopped the contraction. They found the soft alloy only took about half the contraction of cast iron. A ribbed plate was equal to a solid plate. With cement in it there was a tendency to sagging between the concrete and the bottom of the alloy. Bars were placed every four or five inches along the frame to keep the sand away, which made a solid bed of the bars and frame. The biggest frame in use was 36 in. by 24 in., and then every four or five inches a block was put under the alloy. Contraction or expansion depended on the mixing of the plaster. It was a fairly difficult job to define the proper quantities of water and cement, but they found so long as they adhered to the maker's instructions they did not get any trouble.

Regarding the use of the gauge and the number of patterns on a plate, MR. SQUIRES advised the placing of the middle one first and the others later. He used double-sided plates, as the method did not lend itself to single-sided plates. There was risk of damage to one half of the pattern and limitations of the machines used. His manager considered 20 castings or more was a machine moulding job. He would say 50 to 100 was worth while, but it would depend upon the labour available. The gauge was intended to be used to check flat patterns.

On the proposition of Mr. Callaghan, seconded by Mr. Lester, a hearty vote of thanks was accorded to the lecturers.

# FORTHCOMING EVENTS

*(Secretaries are invited to send in notices of meetings, etc., for inclusion in this column.)*

**FEBRUARY 15.**

*Association for Scientific Photography* :—"Photography Applied to Physico-chemical Research," by Dr. A. E. I. Vickers. At Imperial Chemical Industries, Limited, Billingham, Co. Durham, at 4 p.m.

*Keighley Association of Engineers* :—"The Future of Industrial Administration," by G. S. Mason. At Devonshire Buildings, Devonshire Street, Keighley, at 7.30 p.m.

**FEBRUARY 16.**

*Institute of Economic Engineering* :—"Planning in the Foundry," by F. W. Bates. At the Chamber of Commerce, New Street, Birmingham, at 2.30 p.m.

**FEBRUARY 18.**

*Sheffield Society of Engineers and Metallurgists* :—"The Future of Co-operative Research in Iron and Steel," by Sir Charles F. Goodeve, F.R.S. At the Royal Victoria Station Hotel, Sheffield, at 6.15 p.m.

**FEBRUARY 20.**

*Institute of Welding* :—"The Fabrication of Aircraft Fuel Tanks in Aluminium Alloy Containing 3 per cent. Magnesium," by W. K. B. Marshall. At Manchester.

**FEBRUARY 21.**

*Institute of Welding (South-Western branch)* :—Dinner. At the Grand Hotel, Bristol.

**FEBRUARY 22.**

*Institute of Welding (East Scotland branch)* :—"Automatic Welding," by R. R. Sillifant. At the Heriot Watt College, Chambers Street, Edinburgh, at 7.30 p.m.

*Manchester Association of Engineers* :—"The Manufacture and Properties of Modern High Strength Castings." Part I: "High Duty Iron," by J. J. Sheehan. Part 2: "Steel Castings," by C. H. Kain. At the Engineers' Club, Albert Square, Manchester, at 6.45 p.m.

**FEBRUARY 26.**

*British Society for International Bibliography* :—"The Principles of Alphabetical Arrangement," by A. H. Chaplin, and "An Industrial Information Department," by W. John Merrick. At the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2, at 2.30 p.m.

**Institute of British Foundrymen**

**FEBRUARY 16.**

*Bristol and West of England branch* :—"Patternmaking and Material," by G. W. Wearing. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

**FEBRUARY 23.**

*Bristol and West of England branch* :—"The Production and Application of Special Types of Cast Iron," by A. E. McRae Smith. At Gloucester.

*East Midlands branch* :—"Metal Shrinkage," by Dr. H. T. Angus. At the College of Technology, Leicester, at 6 p.m.

*Wales and Monmouth branch* :—"Consistency and the Cupola," by C. A. Payne. At the Engineers' Institute, Cardiff, at 2.30 p.m.

**FEBRUARY 25.**

*Sheffield branch* :—"Review of Sand-binding Materials and Compounds," by C. Wood. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

**FEBRUARY 27.**

*Birmingham branch* :—"Magnesium Foundry Practice," by J. Partridge. At the James Watt Memorial Institute, Great Charles Street, Birmingham, 3, at 7.30 p.m.

*London branch* :—"Opportunities for the Foundry Technician in India," by J. Blakiston. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

**MARCH 1.**

*Falkirk section* :—"Patternmaking," by G. C. Wilson, and annual business meeting. At the Temperance Café, Lint Riggs, Falkirk, at 6 p.m.

**MARCH 2.**

*Lancashire branch* :—"Cupola Control," by C. A. Payne. At the Engineers' Club, Albert Square, Manchester, at 3 p.m.

**MARCH 5.**

*Burnley section* :—Annual general meeting. At the Municipal College, Ormerod Road, Burnley, at 7.30 p.m.

**MARCH 9.**

*Scottish branch* :—"The German Non-ferrous Casting Industry," by H. Ellis, and annual business meeting. At the Royal Technical College, George Street, Glasgow, at 2.45 p.m.

*West Riding of Yorkshire branch* :—Prize winning Paper in the S. W. Wise memorial competition. At the Technical College, Bradford, at 6.30 p.m.

*Lincoln section* :—"Modern Research on Cast Iron," by H. Morrogh. At the Technical College, Lincoln, at 2.45 p.m.

**MARCH 23.**

*Bristol and West of England branch* :—"The Foundry," by W. McCormick. At the Merchant Venturers' Technical College, Bristol, at 7 p.m.

*Lincoln section* :—"A Discussion of Problems in Jobbing Ironfoundries," by A. E. McRae Smith. At the Technical College, Lincoln, at 2.45 p.m.

**MARCH 25.**

*Sheffield branch* :—"Precision Casting by the Lost Wax Process," by Adam Dunlop. At the Royal Victoria Hotel, Sheffield, at 7 p.m.

**MARCH 27.**

*Birmingham, Coventry and West Midlands branch* :—"A Survey on the Mass Production of Small Steel Castings," by W. H. Bamford. At the James Watt Memorial Institute, Great Charles Street, Birmingham, at 7.30 p.m.

*London branch* :—"The Education and Recruitment of Foundrymen," by Dr. D. H. Ingall. At the Charing Cross Hotel, London, W.C.2, at 7.30 p.m.

**MARCH 30.**

*East Midlands branch* :—Annual meeting and short Paper competition. At the Technical College, Derby, at 6 p.m.

*Wales and Monmouth branch* :—"Production of Tank Wheels in a Mechanised Blackheart Malleable Foundry," by A. B. Bill and J. Peers. At Newport.

## ABRASION OF ROLLS

Referring to slip between roll and material during a discussion on a Paper entitled "Roll Manufacture and Application," submitted by A. E. Murton at a meeting of the Association of Iron and Steel Engineers, and published in the "Iron and Steel Engineer," November, 1945, a speaker stated that there was always a slip on every roll. Within the angle of bite, or arc of contact, there were two distinct components of bar speed as separated by a neutral point where speed of bar and roll surface corresponded. The first was when the roll face was moving at a greater speed than the material, the second when the bar emerged faster than the surface speed of the roll. There was thus a constant state of abrasion on the simplest kind of rolling, and that was augmented by the varying speeds created by varying diameters of a grooved roll.

## ENGINEERS TO BE RELEASED FROM E.W.O.

An announcement by the Ministry of Labour states that the engineering industry is to be withdrawn at the end of three months from the Essential Work Orders. This is the first industry to be de-scheduled under the terms announced by the Minister last December. Announcements of the decontrolling of further industries are expected shortly.

# SOME NOTES ON HIGH-DUTY CAST IRONS*

By A. H. HORTON

In reviewing high-duty cast irons, what is the chief cause of applications failing in service? Perhaps the greatest cause of failures is the lack of resistance to shock in the castings where these have been made to replace steel. Caution should be exercised when replacing steel by high-duty cast iron, remembering that although the tensile strength is approaching that of steel, the ductility is almost nil. These irons will stand repeated shocks of small magnitude without forming cracks, but will fail under a single heavy impact blow. From test-bars it is known that most high-duty cast irons are greatly superior to ordinary grey cast iron in their impact value as tested on the Izod machine.

What, then, is the cause of many failures? Is not the answer that the high-duty cast irons, being low in total carbon content, have a much greater contraction than ordinary cast iron and therefore contain more pronounced casting stresses, which, if not relieved by a simple anneal at a comparatively low temperature, may result in a casting which is relatively weaker than a grey cast iron, due simply to these stresses.

Good impact resistance can be best obtained by:—(1) Keeping the embrittling phosphorus content as low as possible; (2) designing so that the least possible stresses are set up by different rates of cooling of thick and thin sections; (3) remembering that where cores or projecting parts of the mould are almost surrounded by the metal, this sand becomes so heated that the cooling rate of the metal is greatly reduced; (4) that correct location of the gates into the mould to ensure even cooling can often help in reducing casting stresses; and (5) a stress-relieving anneal to eliminate most of the casting stresses if the casting design warrants it.

### Production of High-duty Cast Iron

The production of many types of high-duty cast iron is bound up in the correct melting of high percentages of steel in the cupola charges. Correct total carbon content is all important, not too low due to excessive oxidation, resulting in a hard iron with a high shrinkage, nor too high giving a weak iron. A total carbon content between 2.7 and 3.0 per cent. is generally considered good for the production of iron giving good all-round properties without the addition of any alloy material. This can best be obtained by melting mixtures containing 60 per cent. and over of steel scrap, the balance being low-phosphorus pig-iron, preferably hematite, returns of the same mixture and ferro-alloys to adjust the silicon and manganese content.

Control of total carbon is necessary, so also is it essential to control the relative amounts of graphite and combined carbon. This control is obtained by the process known as "inoculation" or graphite deposition, by which means the size and type of graphite deposited, as well as the amount, can be predetermined with a fair degree of accuracy. Inoculants used for the production of high-duty cast iron include ferro-silicon, calcium-silicate, nickel and even graphite.

Barnes and Hicks[1] use a mixture of ferro-silicon and aluminium swarf. In the make-up of the mixture of high-duty cast iron the silicon content should be adjusted to suit the section of the castings. Hardness and strength in these irons are fairly even over one section thickness, but will vary for different sections. Thus for thin sections it is best to add the normal amount of inoculant at the spout to a metal containing a fairly high silicon content in the base metal, rather than excessively dope a very white low-silicon iron in order to obtain a metal grey enough to suit the section of the casting. Where the castings to be poured vary considerably in section, a compromise must be sought, the castings being grouped together in relation to their section and the metal analysis made to suit the average section. The amount of inoculant can then be varied to a slight extent to obtain metal suitable for each group of castings. The dilution charges between two grades of iron can often be utilised to obtain the correct strength in thin castings.

### Cupola Practice

Cupola practice for high-duty cast irons follows that of any good-quality cast iron; great care should be exercised in obtaining a suitable coke bed. Selected coke should be used and the bed packed firmly by poking through the tuyères. It should be evenly burnt through being made up with about three loads, allowing the previous load to burn evenly through to a red heat before adding the next load. The bed height is best found by experiment. Where high steel charges are melted, the Author has found that a bed 48 in. above the tuyeres is necessary in their cupolas to give the volume of heat to the metal to ensure hot metal on the first tap and also the required total carbon content to the metal. Patching the cupola should be done to maintain standard dimensions. The bottom should be rammed to a standard slope in order efficiently to drain the well of the cupola. The taphole should be of such a diameter as to deliver the correct rate of flow of metal for inoculation, especially if the inoculant is run in by mechanical means.

In making up the bed height to 48 in. above the tuyeres, it must be remembered that this includes coke for melting the first charge of iron and the last 6 to 8 in. of bed coke should be added just prior to charging the cupola. Level charging is essential and correct placement of the charge constituents is necessary to obtain even melting. The cupola should be kept charged to the sill level right up to the last charge in order that blast conditions remain fairly constant inside the cupola.

As the last few charges sink down in the cupola stack the blast pressure should be reduced to maintain a

*A Paper read before the East Anglian Section of the Institute of British Foundrymen.

## High-Duty Cast Irons

uniform volume of blast. The weight of metal charge is best fixed by the coke charge, which should maintain a 6- to 8-in. layer between the charges. This weight is best found by building a ring of bricks 7 in. high to the diameter of the cupola, and filling with coke, levelling off and then weighing. Accurate knowledge of the amount of metal tapped is necessary in order to locate the different grades of metal; a suitable weighing machine from which the ladle is suspended is advised.

With high-duty cast irons the attainment of a high tapping temperature is essential in order that the best results are obtained by the inoculation process. Economy of coke is best exercised by finding the most efficient coke-to-metal ratio. It is not economy to cut coke charges below this ratio or to cut down the bed height, as the result would only be dull and hard iron. Although steel content is perhaps the most important factor in controlling total carbon content, other factors influencing it are the volume of air entering the cupola and the quality of the coke and amount added per charge.

Sufficient coke per charge must be added to melt really hot (1,450 deg. C.) and also to add the carbon necessary to bring up the carbon content of the metal to the required level. Where high percentages of steel are used, care must be taken to obtain suitable steel scrap for melting. Alloy steels must be excluded, but manganese steel, charged in the correct proportion, may be used to add the necessary manganese in place of ferro-manganese, manganese briquettes, or spiegeleisen.

Much research into the melting of steel in the cupola has been done. Some excellent work carried out recently by Rambush and Taylor,[2] in which they quenched out a cupola fully charged during the blow and then examined each charge layer by layer, throws much light on melting conditions. It was found that there is little carbon pick-up until the surface of the steel is actually molten and carbon is absorbed by the molten drops of steel.

A careful control should be kept on the supply of steel scrap. Cut up steel rails of fairly high carbon content make idea material, as also do fishplates, bar-ends and the scrap material from the oxy-acetylene cutting process. Plate material and steel sections, if thin and rusty, should not be used, as oxidation with the resultant iron of low carbon content is produced, which sets rapidly with a high shrinkage. Testing each ladle of metal to ensure its suitability for the job is necessary and some form of chill test is advised.

### Types of High-duty Cast Iron

Early efforts to produce high-duty cast iron by very low carbon contents were often unsuccessful, especially as to the impact resistance of the metal produced. This was due to the dendritic structure produced, the graphite being of the fine eutectic or grain boundary type. This type of graphite has been proved to produce an iron weak in impact strength. The process of "inoculation" with ferro-silicon, and more especially calcium-silicide, usually resulting in the formation of fine normal graphite and a strong metal both in tensile strength and impact value. This is now the accepted method for producing most high-duty cast irons, including Ni-Tensyl and Meehanite metal.

The highest strength iron now being produced in any quantity is the "acicular" iron. This is an alloy iron containing nickel and molybdenum. These exceptionally high-strength cast irons have a high hardness often well over 300 Brinell, and yet are reasonably machinable, the explanation being that the structure consists largely of free ferrite needles, together with residual austenite high in carbon. If given a low-temperature anneal, these irons increase still more in strength.

A trial test of "acicular" iron was made by the Author with a base metal containing 65 per cent. steel scrap, the balance being low-phosphorus pig-iron, returns of the same mixture, ferro-silicon and spiegeleisen. The tensile strength as cast was 30.4 tons per sq. in. on both the 1.2 in. and the 0.875 in. dia. test-bars. After a simple anneal for 1 hr. at 300 deg. C., the strength rose to 35 tons per sq. in. on both sizes of bar (35.0 tons on the 0.875 in. and 35.7 tons per sq. in. on the 1.2 in. dia. bar). Impact tests carried out on the Izod machine on test-pieces machined to 0.798 in. dia. from the 1.2 in. dia. transverse test-bar gave 26, 26, and 27 ft.-lb. as cast. The Brinell hardness was 340, but the material, though tough, was machinable. The impact strength of ordinary high-phosphorus grey cast iron would be 5 to 8 ft.-lb., whilst that of a pearlitic high-duty cast iron would be 16 to 20 ft.-lb.

The composition of the metal was:—T.C, 2.5; Si, 1.81; Mn, 0.93; P, 0.11 per cent., whilst 2 per cent. nickel and 0.8 per cent. molybdenum were added. Nickel "F" shot and ferro-molybdenum, together with 0.5 per cent. Si in the form of 45 per cent. ferro-silicon, were added to the stream of metal at the spout. An experimental cast of high-duty cast iron using ferro-silicon and aluminium swarf in the proportions used by Barnes and Hicks[3] was made using 90 ozs. to the ton of the inoculant. The base metal was a 60 per cent. steel mix. The tensile test on a 1.2 in. dia. bar was 21.7 tons per sq. in., with an impact figure of 19.5 ft.-lb. on the 0.798 in. dia. bar.

### Alloys Added to Increase Strength

Nickel is added to increase strength, the equivalent amount of silicon being left out; copper is also added in the same way, but the impact strength is, however, slightly reduced. Nickel and copper together increase strength, whilst nickel chromium and copper-chromium additions give an all-round increase in strength. Molybdenum increases the impact value, and nickel-molybdenum and copper-molybdenum both increase the strength and also the impact value.

### The Heat-treatment of High-duty Cast Irons

Most of the lower strength high-duty cast irons, *i.e.*, those with a tensile strength between 20 and 25 tons per sq. in., have a structure which consists of graphite flakes in a matrix of pearlite or sorbitic-pearlite containing combined carbon to the extent of 0.60 to 0.85 per cent. By treating this matrix in a manner similar to steel of the same carbon content, it is found that one can quench out in water or oil from just above the critical temperature to a martensitic structure which, on tem-

pering to temperatures from 300 deg. C. upwards to 600 deg. C., result in the breakdown of the hard and brittle martensite into troosite, sorbite, or sorbitic-pearlite. This treatment, quenching followed by tempering, gives an all-round increase in the physical properties, the toughness being increased by a considerable extent. Whilst the tensile strength is increased by this method, so also is the hardness, and most machining must be done before hardening. However, by tempering at a fairly high temperature, hardness figures in the region of 300 Brinell can be obtained, and this metal is quite machinable, giving in an "A" Meehanite a tensile strength of around 33 tons per sq. in. *However, not all castings will stand the shock of even warm oil quenching and only castings of robust design or even sections should be attempted.*

### Soft Grey-iron Castings

It is useless to try and improve soft grey-iron castings containing much free ferrite in their microstructure, as the heating for quenching only deposits still more graphite, giving little or no improvement. A low total carbon iron with fairly stable carbides is necessary for heat-treatment. Where casting stresses are likely to be heavy or where the problem of freedom from distortion is important, castings may be heat-treated by a simple low-temperature anneal so as to be almost free from internal stress. Care must be taken to see that the casting is not overheated. This causes a marked deterioration in internal structure due to more graphite being deposited, with the resultant loss in strength.

A maximum temperature of 450 deg. C. has been stated for the stress-relieving temperature of high-duty cast irons; this is a safe figure for irons of unknown composition, but if the composition is known, iron with a total carbon content of below 3 per cent. can be taken at least 100 deg. C. higher than this, resulting in a casting which has less resultant internal stress.

Yet another heat-treatment that can be applied to high-duty cast iron is "shorterising"; that is, the surface hardening of the metal by torch flame heating, followed by a quench from a following jet of water. Such items as gear teeth and cams are suitable subjects. The hardened surface has a structure consisting chiefly of martensite with a hardness of about 550 Brinell; this merges into troostite, then to sorbite, and finally to the pearlite of the base metal.

The work of Bain in producing the S-curves for the heat-treatment of alloy steels and their application to "austempering" or hot-quenching of high-duty cast irons renders it much safer to heat-treat irons by this method, the risk of cracking due to quenching stresses being reduced considerably due to the higher temperature of the quench. In "austempering" castings are quenched direct into a salt bath and held at a moderate temperature for such a time as to allow the austenitic structure to transform to the structure prevailing at the tempering temperature. The time necessary is obtained from the S-curves of the iron of that composition. By varying the temperature of the bath, the structure may be troostite, sorbite or pearlite, and results are often as good as the normal quench and temper treatment: the use of a salt bath, however, limits the size of castings that can be treated

### Mechanical Properties of High-duty Cast Irons

Much has been stated in the technical Press of the properties of the high-duty irons manufactured by the various processes. Braidwood[4] gives complete analysis, tensile strength, hardness and impact strength. McRae Smith[5] gives tensile strength, while the International Meehanite Metal Company, Limited, in their booklet[6] give details for seven processes of metal for general engineering castings.

REFERENCES

[1] I.B.F. Proceedings, 1943-44.
[2] Paper presented at I.B.F. conference, 1945.
[3] *Loc. cit.*
[4] "Cupola Melted High-duty Cast Irons." THE FOUNDRY TRADE JOURNAL, May, 1942.
[5] "Melting and Casting Problems in the Production of High Strength and Special Duty Iron Castings." I.B.F. Proceedings, 1940-41.
[6] "The Specification of Meehanite Metal."

## NEW PATENTS

*The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.*

572,964 STEVENS, A. H. (Finkl & Sons Company, A.). Steel alloys and die blocks made therefrom.

572,965 ARNOLD, J. C. (Basic Refractories, Inc.). Manufacture of refractory materials.

572,978 ENFIELD ROLLING MILLS, LIMITED, and SYKES, J. Copper base alloys.

573,022 WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY. Method of reducing molybdenum trioxide to molybdenum.

573,057 FORD MOTOR COMPANY, LIMITED. Steel alloys and heat-treatment therefor.

573,077 LENNOX, J. W. Process for the manufacture of articles or masses from metal powders.

573,085 BIRMINGHAM ELECTRIC FURNACES, LIMITED, and HANCOCK, P. F. Production of gaseous atmospheres for the cementation of iron and steel.

573,113 JOHNSON & COMPANY (LONDON), LIMITED, A., and BANO, E. A. Manufacture of alloys.

573,139 BULPITT & SONS, LIMITED, and ASHTON, F. Annealing furnace.

573,149 PRYTHERCH, W. E. Production of magnesium.

573,171 OEL- & CHEMIE-WERK AKT.-GES. Manufacture of a binding agent for core sand.

573,176 MOND NICKEL COMPANY, LIMITED, and RHODES, E. C. Soldering and brazing.

573,201 JOHNSON, MATTHEY & COMPANY, LIMITED, CHASTON, J. C., and DAVIES, D. A. Joining of glass or ceramics to metal.

573,285-6 BRAYSHAW FURNACES & TOOLS, LIMITED, BRAYSHAW, S. H., NEWMAN, F. C., and RUSHTON, F. Silica gel apparatus for the adsorption of moisture from air or gases.

573,287 ELECTRIC RESISTANCE FURNACE COMPANY, LIMITED, and COOK, A. J. Heat-treatment furnaces.

573,304 MACNAIR, J. L. P., and GENDERS, R. Manufacture of steel.

## A NEW SPECTRO-ANALYTICAL APPARATUS

An entirely new direct-reading instrument which allows the quantitative chemical analysis of as many as 11 elements in metal alloys, chemicals, and a wide variety of other materials in less than one minute, has just been announced by the Applied Research Laboratories, 4336 San Fernando Road, Glendale, California, and the Harry W. Dietert Company, 9330, Roselawn Avenue, Detroit, 4, Michigan.

Quantitative spectro-chemical analysis is the specific purpose of this new instrument, hence its name, the Quantometer. The principal advantage of the Quantometer is the great speed with which it can simultaneously and automatically measure the quantities of a number of elements present in a sample. These results appear directly as percentage composition on a series of counters, one for each element being determined. Only one operator is necessary.

The great rapidity with which analysis can be performed is certain to revolutionise many processes where step by step control of composition is necessary. For instance, in the metal producing industry, many separate melting operations or the holding of melts while composition is being checked, can be eliminated. The Quantometer offers great savings in fuel and overhead costs. Further, the alloys produced can be kept to much narrower specification limits than has heretofore been possible. This may well usher in a new era of alloys, in which certain types may be produced to provide optimum physical properties by means of exact chemical and physical control.

### The Three Units

The Quantometer consists of three units, a source unit which provides a powerful spark to the sample being analysed, a spectrometer which disperses the light from the spark into a spectrum, and a recording console where the final analyses are shown.

The source unit differs from the conventional units used in spectrochemistry chiefly in the very high-intensity discharge which it produces. The spectrometer employs an original diffraction grating and is fitted with 12 receivers arranged to record light from as many spectrum lines. These receivers, employing highly accurate integrating electrical circuits, replace the troublesome photographic emulsion used in spectrography. The recording console supplies all of the various voltage required to operate the receivers and houses the counting units which provide the final direct analyses.

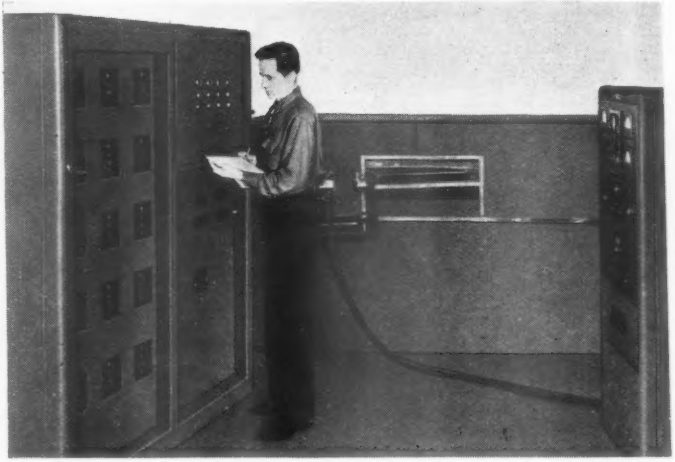

FIG. 1.—THE QUANTOMETER—AN APPARATUS WHICH CAN LARGELY REPLACE WET ANALYSIS FOR ROUTINE TESTING

## GROVESEND STEEL & TINPLATE COMPANY

A meeting of the Grovesend Steel & Tinplate Company, Limited, is to be called for March 30, at which a resolution will be submitted for the voluntary winding-up of the company with a view to the merging of its assets and liabilities (other than the 4¼ per cent. first mortgage debenture stock) with those of the parent company, Richard Thomas & Baldwins, Limited. The holders of the company's debenture stock will be repaid in the liquidation at 102 per cent. with accrued interest, in accordance with the terms of the trust deed. The directors have arranged with the holders of the ordinary shares—namely, Richard Thomas & Baldwins, Limited, that in the winding-up the holders of the 6½ per cent. preference shares will be paid 25s. per £1 share. The holders of the preference shares will also receive the half-year's dividend which falls due for payment on April 1.

Arrangements have been made whereby Richard Thomas & Baldwins, Limited, will take over all staff and workpeople employed by the Grovesend Steel & Tinplate Company and all contracts.

## NOTES FROM THE BRANCHES

*BIRMINGHAM, COVENTRY AND WEST MIDLANDS BRANCH.*—On January 30, about 70 members visited the works of W. & T. Avery, Limited, where they were received by Mr. A. J. Shore, the branch president, who is an executive on the staff ot the Soho Foundry. Both the ironfoundry and the die-casting shops were inspected and general commendation was expressed at the technical control imposed and the high quality of the productions.

# THE TECHNOLOGICAL PRINCIPLES OF CASTING DESIGN

This Paper* by Prof. Victor M. Shestopal, of the Stalin Machine Tool Institute, Moscow, was the first ever received by the Institute of British Foundrymen from Russia. It was read before several branches of the Institute. In London the Paper, which was illustrated by lantern slides, was presented on behalf of the Author by Mr. C. H. Kain, joint managing director of Lake & Elliot, Limited. The dicussion was opened by MR. B. LEVY, who suggested that there was an attempt by the Author to over-simplify certain standards, particularly in regard to tapers, for example. He was impressed by tapers of 11½ deg. on depths of 1 ft. or less, which appeared to be inadequate, particularly on shallow facings; reference was made to a minimum facing thickness of $\frac{3}{8}$ in., and a minimum taper of 11½ deg. appeared to be quite inadequate. He personally would adopt a minimum taper nearer 45 deg. The attempt to over-simplify design was rather apparent also on the cone pulley, where a flange was eliminated, thereby eliminating a spigot which was obviously holding the gear for the tracking arrangement on the pulley, and where it was noticeable that the whole strain of the drive was taken up on the screws which held the gear to the cone pulley.

MR. KAIN felt that the recommendations with regard to taper would be better understood when the Paper was published, so that one could study it carefully; he did not profess to understand fully what was meant. Presumably the 11½ deg. was meant to be 11½ deg. from the vertical.

### Splitting Castings to Facilitate Moulding

MR. S. L. FINCH said that one of the most important features of the Paper was the reference to the splitting up of castings into two or three different sections; that was opposed to the tendency in this country, which was increasing, to join three or four castings together and thus increase moulding costs. Feeling that the Paper would be of great value to designers, in that it gave much interesting information on the problems confronting the founders, he suggested that it might be presented to the Institution of Production Engineers or some other engineering society.

Commenting on the permissible deviation of weight of castings, which was given in the Paper as from 4 to 10 per cent., Mr. Finch regarded it as excessive and said he did not think the buyers of castings would be prepared to pay for 10 per cent. excess weight on their estimated weights. The Author had stressed a most important fundamental principle when he had referred to the designing of steel castings with a view to promoting directional solidification.

### Weight Tolerances

MR. KAIN urged that the problem of breaking down a unit into several components must be considered in its broadest aspect. Such breaking down into a number of components might simplify moulding problems, but it might very greatly increase the cost of machining and assembling; that cost had to be weighed against the difficulty of making the unit as a whole. There was also the question of the quality of the unit and its satisfactory service; if by breaking it down into a number of small components and machining them and putting them together we obtained a more satisfactory ultimate product, then possibly the extra expense was warranted. It was a very big problem. From the point of view of foundrymen, simplicity in design and the breaking down of a unit into a number of simpler components was desirable; but they must bear in mind that the engineer wanted as much as he could get in one piece, in order to reduce machining and assembling costs.

The weight variations given in the Paper appeared to be generous; but the Author had stated that the figures given were maxima, and that if one could beat the specified figures it was a good sales point. Mr. Kain welcomed the suggested tolerances because they served as a criterion or as a guide by which to work; particularly did that apply to dimensions. One received a drawing for a casting carrying tolerances on the machined dimensions; they might be very fine tolerances, perhaps only 0.001 in. or less, but the machinist knew the accuracy to which he had to work. On the other hand, the casting dimensions were just stated as X inches or X millimetres, and if they proved to be not exactly X there was frequently an argument between the machinist, the engineer and the foundryman as to whether the casting was correct. It was desirable to have some sort of standard of tolerances published and known, a standard which could be attained by normal good foundry practice; then if the steel founder could work to smaller tolerances, that was a very good point in favour of the quality of his castings. But the practical point was that such a standard would give a starting point, which at present was not provided.

### Progressive Solidification in Cylinders

MR. S. T. JAZWINSKI, referring to the Author's recommendations for the design of castings such as cylinders, asked how the Author could expect to promote progressive solidification in such castings, and how he would feed them.

MR. KAIN agreed that the Paper was not quite clear on the matter, possibly due to an error in translation. The paragraph read:—" The thickness and cross-section of walls should concur with the general laws for obtaining a good casting, solidified progressively and cooled regularly. In tall castings the thickness of the walls should as a rule increase from top to bottom as they stand in the mould." As Mr. Jazwinski had pointed out, it was difficult to visualise progressive solidification in such a design. It seemed a case for bottom gating with pressure feeding, with the atmospheric head

*See F.T.J. December 13 and 20, 1945.

## Casting Design

or well gate head at the bottom of the casting, whereby the aim was to secure freezing from the top to the bottom and not from the bottom to the top, which latter was the usual method in gravity-fed castings.

MR. H. O. SLATER (past branch-president) commented that, although laws were made, the administrators must still treat each case on its merits. That principle applied to castings, as to other things. The Paper would perhaps indicate to designers that there was something more than they had thought in designing a casting from the foundry point of view; once they got that idea well into their minds they would be more tolerant and would produce designs which were more efficient from the foundry point of view.

MR. H. SUMMERS, referring to an illustration showing what he called the up-side-down position, said that although the Author had stated in the Paper that it would be better to have the large plate at the bottom rather than at the top, the illustration showed the plate at the top. Therefore, he suggested that such illustrations, when published, should be reversed.

MR. KAIN agreed that a number of the illustrations would be better reversed, to show the desirability of having extensive machining surfaces in the bottom of the mould. That was a fundamental principle of founding which was not mentioned in the Paper.

MR. J. B. BOYD said the Paper went quite a long way towards establishing some basis on which casting design could be worked out; and he suggested that if it could be used as a basis for casting design in this country it would go far towards simplifying the moulders' problems, for they were confronted with quite a number of problems due to the designer trying to be very clever and putting together pieces which formerly were made separately. On several occasions Mr. Boyd had found it more successful to invert a casting and feed it from the bottom than to feed from the top.

### Bosses and Design

A MEMBER, referring to the suggested allowances for projections on castings, said he believed the minimum amount of projection for a boss was $\frac{3}{16}$ in. on a reasonably small casting. That seemed to be rather in conflict with the requirement that the section of the casting should not be drastically altered. He mentioned it because the actual thickness of the casting in question was (locally) considerably greater than that to which one was accustomed.

MR. KAIN said the use of bosses of a substantial height to allow of ready machining without cutting into the body of the casting did cause a local thickening which would be undesirable. If one were presented with such a case in practice, one would probably recommend that the casting be lightened out on the inside to compensate for that thickness. It would be a case of balancing ease of machining to overcome distortion against the difficulties from the metallurgical feeding point of view.

### Modulus of Elasticity and Design

THE BRANCH PRESIDENT (Mr. A. J. Murphy, M.Sc.) shared the feeling that the Paper indicated an attempt at over-simplification. Moreover, one had the impression that the Paper neglected very largely the methods of running castings. The Author seemed to become interested in the metal only when, by some means, it had got into the mould. Surely the method of running must affect the development of hot spots in the mould, and subsequent distortion, and so on. Perhaps that part of the Paper might have been strengthened. With regard to the statement to the effect that the internal stress developed in a casting could be regarded as roughly proportional to the modulus of elasticity of the material, he said that that might be a dangerous fallacy, because the modulus of elasticity did not affect the cooling casting until the metal had acquired some appreciable elastic limit. The extent of the internal stress developed, if contraction were restricted, depended on the temperature at which the metal began to become stiff. If the elastic limit were acquired only at low temperature, the stress developed would be small: then it would not be proportional to the modulus of elasticity of the material.

The problem of the strength to be stipulated in different parts of castings was very important, and the foundry industry should realise where it was going in adopting that style of specification. There was a great deal to be said for it; but the responsibility on the foundries would be considerably greater if they undertook to produce in a particular part of a casting a certain minimum strength. He knew of only one or two isolated instances in which that was being done. In the light alloy field particularly there was a very strong trend towards marking on a drawing the critical part of a casting; that placed on the foundryman the onus of seeing that his skill and attention were directed towards ensuring the maximum soundness of metal in such parts. But to put that on a quantitative basis and specify that in certain parts of a casting he must realise certain minimum mechanical properties was somewhat revolutionary.

On the question of splitting up a casting into two or three pieces, to be joined together later, he said it might be desirable to do that in order to simplify the process of casting. On the other hand, the constructor of the ultimate product must take into account the costs of machining and assembly, and so forth. Further, there was a loss of rigidity in the assembled product, and certain very desirable features of cast metals were lost if the cast structure were replaced by components and a series of mechanical joints.

### Cut-out Test-pieces

MR. KAIN said the Author *had* referred to the running of the metal, for he had stated that the design of the casting must be such as would allow the liquid metal to flow freely into the mould; but he had not enlarged upon it. The great thing was to have somewhere in which to put the metal, and it was one of the fundamental principles of foundrymen that they liked to run metal into metal and not just drop it into a

big space. The comments made by the branch president about the stresses in a casting being related to the modulus of elasticity were quite correct; probably the Author was trying to point out that the resultant stresses in castings of different metals might vary, that the stresses in all castings of the same design were not necessarily the same.

There was a tendency amongst inspecting engineers to ask for test results on test-pieces cut out of the castings. Mr. Kain confessed that he sympathised with that viewpoint, and that if he were an inspecting engineer he would wish to be satisfied that the physical properties, as given to him, did represent the material in the casting and not the material in a separately-cast test-bar. Foundrymen must appreciate that tendency, and either cope with it or make some constructive suggestions on that basis.

### Vote of Thanks

MR. D. C. PINCOTT, proposing the hearty thanks of the meeting to the Author of the Paper, and to Mr. Kain for his able presentation of it, said that foundrymen had on occasions cursed designers for the designs they had thrust upon the foundry. Before he had seen the Paper he had wondered how far the Author would cover the subject, for the subject was such that, if it were not covered widely, the effect of the Paper would be entirely lost. Having seen the Paper, however, and having listened to Mr. Kain's presentation of it, one felt that if some of the designers could be educated to absorb the principles put forward in it, the foundryman would be very much better off. Some very sound principles were stated in the Paper, though one felt they were of an academic nature, and certainly in this country there would be a great deal of difficulty in applying a large majority of them. He supported the suggestion already made, that probably a good deal of benefit would result if the Paper were presented to an engineering body such as, for instance, the Institution of Mechanical Engineers; then foundrymen might receive designs which could be moulded without a great deal of trouble. At present, there was a rather mixed array of designers in this country; some were fairly flexible and would make concessions in design, whereas others were autocratic and were more difficult. However, the foundryman should consult the designer very frequently with regard to foundry difficulties; he might not always secure concessions, but it was certainly worth trying.

MR. ELLIOTT, who seconded, took up the point that if foundry tolerances were stated they would help the foundrymen to overcome much of the difficulty in connection with inspection generally.

The vote of thanks was carried with acclamation.

MR. KAIN, responding, expressed surprise that none of the speakers had mentioned what he regarded as one of the outstanding points of the Paper. It was entitled "The Technological Principles of Casting Design," and in it the Author discussed, not brass or steel or iron castings, but casting as a method of construction. It emerged quite clearly from the Paper that there was a number of fundamental principles which applied to all the metals handled in the foundry, and

(*Continued at foot of next column.*)

## TWO USEFUL TOOLS FOR THE PATTERNMAKER

By "CHIP"

Two useful tools which can be very easily made by the patternmaker are a magnetic brad driver and a cornering tool shown in Figs. 1 and 2 respectively. Most patternmakers have at some time or other had the annoying experience of trying to pick up small brads from off the bench, which have inadvertently got mixed up with shavings and, incidentally, may have become contaminated by glue or varnish. They have also at times felt exasperated at the failure—once picked up—to hold the brads in position, at, say, the depth of a bedplate pattern, when attempting to fasten a fillet in an almost inaccessible place for the convenient working of a hammer.

This trying of the patience and temper can often be avoided by the use of such a tool as is shown in Fig. 1, which is essentially a piece of magnetised round steel set in a wood handle. The magnetic properties enable brads to be picked up from the

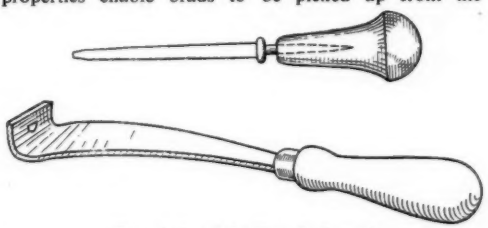

FIG. 1 (upper); FIG. 2 (lower).

most awkward spots and when once retrieved they can be placed with their heads at the point of the tool and pressed in position and driven home tight even underneath the surface if desired, thus rendering the use of a nail set unnecessary.

The rounding of corners on certain patterns can be conveniently accomplished by the aid of a tool such as is depicted in Fig. 2. This consists of a piece of flat steel about 1 in. × $\frac{3}{16}$ in. and 6 in. or so long, suitably handled. A slot cut in the upturned end, of radius equal to that desired on the pattern, acts as a cutter which neatly removes the sharp edges of a pattern, leaving nicely rounded corners of desired shape.

As various sizes of rounds may be required, tools of different diameter cutter may prove useful ranging from, say, $\frac{1}{8}$ in. to $\frac{1}{2}$ in. by increments of a $\frac{1}{16}$ in. Simple tools, the above may be an attractive addition to a patternmaker's kit, and well repay the odd moments spent in their manufacture.

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(*Continued from previous column.*)

that the foundryman's job was to make castings and not to make steel or brass. That was a very useful point to make to engineers, that they should become casting minded instead of thinking of castings in different metals.

# IRON AND STEEL PRODUCTION IN 1945

## BRITISH AND OVERSEAS FIGURES

The British Iron and Steel Federation has recommenced the publication of its Statistical Bulletin, suspended since July, 1939. Some of the principal figures for Great Britain and overseas are appended.

### GREAT BRITAIN

#### Iron Ore

Production of iron ore in 1945 was the same as in 1937 at just over 14 million tons. The distribution between the districts was, however, markedly different, the main feature being the increased importance of the Midland ore fields (South Lincolnshire, Leicestershire, Northamptonshire, Oxfordshire and Rutlandshire), which accounted for almost 70 per cent. of the total production in 1945, compared with 55 per cent. in 1937.

Supplies of iron ore from overseas, which were reduced during the war to about a quarter of the 1937 figure, increased substantially in the second half of 1945 and the figure for the year reached more than 4 million tons. While this was nearly double the 1944 arrivals, it was only 60 per cent. of the 1937 import, supplies being limited by the dock strike and interruption of shipping schedules.

#### Pig-iron

The increased arrivals of higher grade imported ore in 1945 made possible an improved production of pig-iron at 7,107,400 tons, compared with 6,736,500 tons in 1944. Imports of ore were still well below the 1937 level; moreover, production was reduced by the additional holidays and limited in some districts by coke supply, so that the total was still 1.4 million tons less than in 1937. The extent to which a further increase will be possible in 1946 depends on improved arrivals of foreign ore and the availability of coke.

#### Crude Steel

The output of ingots and steel for castings in 1945 was 11,819,900 tons, compared with 12,142,200 tons in 1944, the decline being due to the additional holidays and reduced demand for electric steel. Production in the fourth quarter was at the annual rate of 12,372,000 tons, compared with a rate of 12,213,000 tons in the fourth quarter of 1944.

### PRODUCTION IN OTHER COUNTRIES

#### United States and Other Overseas Producers

Output of steel in the United States rose by nearly 30 million tons, or 58 per cent., between 1937 and 1944. This was due partly to the fact that the American industry operated at 95 per cent. of capacity in 1944, as compared with 73 per cent. in 1937, but also to a definite expansion of capacity of 17.4 million tons, equivalent to an increase of 22 per cent.

There was an even larger proportionate expansion of output in the Dominions and India, ranging from 55 per cent. in the case of India to over 100 per cent. in the case of Canada, between 1937 and their respective peak war years. In general, also, the current level of production is rather below the wartime peak. The output of the smaller overseas producers, such as Brazil and Mexico, also showed substantial increases, although the actual volume of output was still, of course, very small.

#### Western Europe

The considerable expansion in overseas production contrasts strikingly with the position in Western Europe. The neutrals, Sweden and Spain, maintained a comparatively stable level. Production in France and Belgium, however, was drastically reduced to an average of about 25 per cent. and 35 per cent. respectively of the 1937 level, and very much lower levels in 1944-45. In recent months there has been a rapid recovery in these countries, but the level of output in November, 1945, was still only a fraction of 1937—Luxemburg 22 per cent., France 30 per cent., Belgium 32 per cent. This was primarily due to the acute shortage of fuel.

Although the production of coal in France has almost reached the pre-war rate, her imports of coal are seriously restricted. Instead of the 1937 average monthly import of nearly 2.5 million tons (some 40 per cent. of her total supply), average monthly imports in the last quarter of 1945 amounted to no more than 0.7 million tons.

#### Germany

In the case of Germany, Italy and Japan, the wartime figures may not be entirely reliable, but are believed to give a reasonably close indication of the position.

The German picture shows a gradually rising output of pig-iron and of steel ingots and castings from 1937 up to the peak year 1943, when the output of pig-iron was 24.2 million and of steel 30.6 million metric tons. The peak month of the whole war was January, 1943, when steel production was as high as 2.7 million tons, of which the Rhine-Ruhr district accounted for some 1.3 million tons.

From 1938 the total includes Austria (0.7 million tons of steel in 1937); from 1940, Upper Silesia (2 million tons); and from 1941 Luxemburg (2.5 million tons). The drop in 1940 was due to the confusion and reorganisation for the first year of war.

It is of some interest that, contrary to expectation, the wartime steel output of Upper Silesia was not appreciably increased, although that region was made into a reception area for various plants from the Ruhr. The main reasons were that the district possesses neither good coking coal nor adequate iron-ore resources and that once stocks of Ukraine ores were gone, production was difficult to maintain.

Towards the end of 1943, the combined effects of air bombardment and stoppage of ore imports into Germany halted the rise in output and initiated the steady decline which, despite certain sporadic recoveries, continued to the end. The year 1944 opened with a total production of 2.6 million tons of steel ingots and castings in January and closed with 0.99 tons in December. Last year (1945) was chaos, with rail, road and water

transport communications disrupted, power, gas and water supplies constantly cut and such material as was produced accumulating in works and sidings.

Production in the British Zone (Rhine, Ruhr and Hanover areas) is gradually being resumed, but the coal shortage makes it difficult at the moment to rise much above the rate of 100,000 tons monthly both for pig-iron and for steel ingots and castings.

Germany's maximum production of steel ingots in any one year has been fixed by the Control Council at 5.8 million tons, while actual ingot capacity will be limited to 7.5 million tons.

**Italy**

In Italy, production of pig-iron and of steel ingots and castings was maintained at a fairly steady rate until 1943, when loss of territory, destruction of plant by bombing, and the dismantling of equipment by the Germans reduced output considerably. Production ceased entirely in April, 1945.

Industrial production was resumed in Italy in July, 1945, under the "Plan of First Aid," and for 1946 an output of 1.3 million ingot tons of steel is planned, comprising 0.6 million tons of open-hearth steel and 0.7 million tons of electric steel. Production of 0.5 million tons of pig-iron is also planned.

**Japan**

Japan's ingot output in 1929, when presumably steel was still being used mainly for peaceful purposes, totalled 2.29 million tons.

Capacity was built up steadily until 1944, when it amounted to 7.4 million metric tons of pig-iron and 11.5 million metric tons of crude steel; but as this theoretical capacity was dependent upon considerable imports of ore and coking coal, capacity production was not achieved at any period of the war. Raw material shortages and transport difficulties were, however, never so vital to the Japanese war effort as, for instance, in the case of Germany, for the very nature of the war in the Far East precluded any great consumption of steel in the way of shells, heavy artillery, tanks, motor transport, etc.

Steps had, nevertheless, been taken to enlarge steel-making capacity in the territories under Japanese control on the mainland, with a view to avoiding the long hauls to Japan, but 80 per cent. of actual war-time production still took place in Japan proper. The combined production of Japan and the mainland seems to have exceeded 50 per cent. of the total capacity on only one occasion (1943), when output of ingots and castings totalled 7.5 million metric tons. Production in 1937 amounted to 5.6 million tons and in 1944 to 6.5 million tons.

## THE WORKMEN'S COMPENSATION ACT

(*Continued from next column.*)

There are several different schemes, embracing many trades and operations, of particular interest to this field, being the Various Industries Scheme, as under this come foundries and metal works, and another scheme of interest is the Metal Grinding Industries Scheme, which applies to grinding of metals by grindstone and the term grinding includes "hacking" and "rodding."

## THE WORKMEN'S COMPENSATION (PNEUMOCONIOSIS) ACT, 1945

By F. J. TEBBUTT

An Act of which cognisance should be taken is the Workmen's Compensation (Pneumoconiosis) Act, 1945, as it amends certain provisions of the main Acts, which refer to this disease. Pneumoconiosis is a generic term to cover fibrosis of the lungs due to silica dust, asbestos dust, and other dust, and includes the condition of the lungs known as dust reticulation.

The main Acts really apply by schemes referring to many industries, processes, and operations and in these schemes limits of time for doing certain things bulk largely, as, for instance, compensation is not payable where the employee had not been employed in specified employment within a specified time (specified, means the specific limits as laid down in the particular scheme). Provision is made for employers to share cost of compensation where there have been several employers within a certain period, and information must be given as regards these matters within a specified time; and also as regards medical examination on engagement or transference the employee must have been employed in specified employment within a specified period. Now this new Act provides that in respect of any period of war service or war employment, that period shall be disregarded in considering whether the time limits arising from the provisions just mentioned have been overstepped, the objects of the Act being really to put employees who have served in the Forces or in directed employment in the same position they would have been in if they had continued to be employed in their pre-war occupations.

The term "period of war or war employment" is defined in the Act as meaning any period between September 3, 1939 (start of the war) and such date as may be specified in the amendments which will be made in the different schemes to bring into line with the provisions of this Act.

**Details of the Provisions**

Amplifying somewhat an explanation of the provisions of the schemes which will be affected as above, one provision which is in all the schemes is that compensation shall not be payable in cases where the employee has not been employed in the industry giving rise to the disease nor in receipt of weekly compensation at any time within five years previous to the date of the injury. Another provision most common is that persons covered by the scheme are required to be examined every three years and if they leave the industry and return to it after three years a re-examination must take place. These provisions will be among those to be altered to show the disregarding of the period mentioned under this Act, that is, broadly speaking, where the employee has been engaged in any service or employment which he would not have undertaken but for a state of war, and it might be pertinent to note that the employees will be able to go back into the industry and to claim compensation as though they had been in the industry during that period.

(*Continued at foot of previous column.*)

# RATE FIXING AND TIME STUDY*

By W. L. HARDY

A certain notorious enemy of ours once said, "A nation's wealth lies in its man-power." How then can Britain be a poor country? With the shortage of this particular commodity how can it be used so that that which is available is employed to the best advantage. Managements can first of all bring their industrial plants, particularly the foundries, to a state of modernisation with new plant and healthy buildings to house it. Secondly, a system of payment by results should be established that will encourage the worker to give of his best in quantity and quality. To do this, first the worker must be educated into the right way of thinking, as far too often they think that as soon as payment by results is mentioned, the management is out to get more work for very little more money. Once the workers are taught that, as Britain must export to live, only by means of increased production can exports be maintained. The balance of production left over for home can then be used to raise the standard of living for all.

Industry has then to decide which system of piecework to adopt. Amongst these are: (1) Time study by an expert, whose duty it is to measure the work to be done, allowing for rest periods, etc.; (2) by giving each job a basic time and the worker having all he earns above the basic time set; or (3) straight piecework at a price each or on tonnage. To all these systems the attitude of the worker can be best explained by the following extract from a leading newspaper.

### "Man and the Clock"

"How does the worker fare under a timing system? Hitherto, his chief cause of complaint is that the Bedaux and other similar methods have been geared to the profit machine. He feels that he has been speeded up only in the interests of his employers. Under nationalisation this complaint would disappear. The worker would know that his job is being timed in the interests of all including himself, and the rate would be fixed at a level consistent with his physical and mental well-being."

This comment clearly shows the need for close co-operation between the men and the management. Motion study films are made of men at work, the idea being to see which operations could be altered to save heavy and unnecessary work. This shows that some people have realised that if England is to continue to be a great nation, it must get away from its conservative ideas and produce quantity as well as quality.

Some of the systems that are in operation require a large number of clerks to work out the wages, and this must help to increase the already high overhead costs. It would do well to consider the methods used by one large employer who pays a very high day rate for a given amount of work based on careful planning, to get the maximum amount of work from the plant. By doing this wages would then be a routine matter and would be understandable by all.

### Methods of Pricing Work

The following are some of the various methods that have been used to price work during the war period and have proved very successful in helping to obtain a large output of both iron and steel castings.

1.—*Coremaking (Male and Female Labour).*

| | | |
|---|---|---|
| 4 | 45 | 2 cores timed. |
| Mins. | Secs. | 2 cores timed. |
| 4 | 45 | 1st core. |
| 4 | 51 | 2nd core. |
| 9 | 36 | |
| 3 | 12 | + 1/3rd allowed. |
| 12 | 48 | divided by two to nearest ½ min. |

Time allowed, 6 mins. 24 secs.

| | | |
|---|---|---|
| Mins. | Secs. | |
| 21 | 0 | 1st core. |
| 23 | 4 | 2nd core. |
| 44 | 4 | |
| 14 | 21 | + 1/3rd allowed. |
| 58 | 25 | divided by two to nearest ½ min. |

Time allowed, 30 mins.

2.—*Moulding Machine.*

(*a*) Steel. Basic output plus bonus.—A basic figure is arrived at per hour and a bonus is paid for each mould over that. This included operators, closers and labourers, *e.g.*, 10 moulds per hr., 15 made. Twopence per man each over 10 means 10d. per hr. bonus each man. This gets over the problem of how to give the labour other than the actual operators an incentive to work hard.

3.—*Moulding Machine.*

(*b*) Iron. Straight piecework.—Work done—moulding, closing, casting and knocking-out. Four men. Price all in, 6d. per box, 16 × 13 × 5, approximately 200 per day. The price goes up or down according to the size of the boxes and type of work to be made.

4.—*Hand Moulding—Small. Bonus Time.*

A number of minutes or hours is allowed for the job, and all the moulder makes over the time given he takes.

5.—*Hand Moulding—Large. Bonus Time, or Gratuity.*

This is very difficult work to price, as mostly these jobs are one off and require very skilled workers, so if the job is made in a good time the man is given a gratuity in relation to the length of time on the job.

(*Continued on page* 180 *Column* 1)

*A contribution to a symposium on Rate Fixing, organised by the East Anglian section of the Institute of British Foundrymen, Mr. D. Carrick presiding. The Author is on the staff of Lake & Elliot, Limited.

# VENTILATION AND DUST CONTROL IN FOUNDRIES

## EFFECT ON HEALTH AND COMFORT

Mr. Ambrose Firth, in his presidential address to the Sheffield Society of Engineers and Metallurgists, devoted his earlier remarks to the ventilation and dust control in foundries. Later he extended his observations to cover the engineering shops.

In the course of his remarks, the president said that he had decided to deal with a subject which he considered to be of vital importance to industry, affecting as it did the health of the operative and having a very direct bearing on the production which was so vital to the prosperity of our country. The black-out conditions in foundries and engineering shops necessitated by the war had perhaps brought home much earlier than would otherwise have been the case the importance of properly regulated ventilation.

Lack of proper ventilation had undoubtedly an injurious effect on the health of the operative, and could not do other than slow down production. Perhaps this might not be apparent for some time, but its effect would be cumulative. The nation's greatest asset was its man-power, and the maintenance of healthful and comfortable conditions in any industrial plant was therefore of vital importance. No man could give of his best in conditions which were intolerable.

Industrial ventilation was a scientific problem to which far too little regard had been paid in the past, and the works engineer would profit by giving far more attention to it in future. Many of the foundries in Sheffield might not present easy problems and perhaps, due to lack of repair, might be considered by the operative to be all too well ventilated in winter. Much headway had been made with industrial hygiene, but there was undoubtedly some room for a great deal of improvement in many industries, notably the foundry industry. Industrial hygiene covered a wide field of subjects, but perhaps ventilation, heat removal, air cleaning, dust and fume control ranked first in importance. In addition, the managements must now supply hot water for ablution purposes, heat for clothes drying and other purposes.

### Special Difficulties

The foundry, in this respect, presented its own varied and difficult problems, and although in mechanised foundries the solution was not quite so difficult, conditions in heavy and jobbing foundries, such as those which were more general in Sheffield, presented a much less easy problem. Generally, the worst sources of discomfort might be said to come from dust, excessive heat, smoke fumes and draughts.

The essence of good practice in fume and dust extraction was its control and concentration as near as practicable to its place of origin, and so to prevent its spreading into the general atmosphere of the foundry. Ventilation was then reduced to much less costly proportions. Unfortunately, in a heavy foundry, there was no uniformity of process nor fixed source of contamination which could be controlled by permanent dust and fume extraction plant, and, consequently, the whole atmosphere of the foundry became contaminated and required treatment by general ventilation.

In the past, general ventilation by natural air flow had been practised solely by means of roof ventilators. The air flow through such ventilators depended upon the vagaries of the wind and temperature differences between the inside and outside conditions. Both these factors varied between very wide limits and, consequently, the ventilation was quite unstable and unpredictable from day to day. When there was a high wind, large volumes of air were drawn through the foundry, causing cold draughts and disturbance of fumes and dust, whilst on a still day there might well be no ventilation at all.

In conjunction with roof vents, there must be inlets at some points through which to admit the fresh air, but in many foundries no such inlets existed, and therefore the air found its way through open doors, cracks and slots in the building fabric and so on. It was thus completely uncontrolled and might be admitted at uncomfortable low temperatures in a dust-laden condition.

### Dust and Temperature Variations

It would be obvious that conditions which had been tolerated in the past would not be allowed to continue in the future, and the problem would have to be tackled in a bold way. The main sources of discomfort could be grouped and treated under two headings—dust and fumes, and excess and low temperature—and these would have to be treated by much more positive methods than the "hit-and-miss" methods of so-called natural ventilation and no heat at all.

This meant a properly designed mechanical fume and dust extraction plant must be incorporated in the general plant layout and, in fact, form part of the foundry equipment. The air exhausted by this plant must be admitted to the building under controlled conditions of temperature, cleanliness and distribution.

The air in the foundry during the early morning before any hot metal was dealt with and before the effect was felt of the warmth radiated from the stripping of castings, if they were of the type which were stripped daily, required heating, say, up to 50 deg. F., but due to the fact that the warmth in many foundries would not be required after the first hour or two, and that the capital cost was high, the installation made a heavy charge on the foundry overheads.

Dealing with the question of dissipation of heat in the foundry during casting time, it was necessary to pay attention to hot spots such as the areas near the cupola and the castings pits by the dowsing method, that is, by directing jets of relatively cooler air on to the operative at the time of the actual operation. These jets should be positioned to ensure turbulence of the atmosphere, and would give the men working round them sufficient air movement to allow them to

(*Continued on page* 181, *column* 1.)

## NEW INDUSTRIES IN SOUTH WALES

An article in the "Board of Trade Journal" surveys the progress that has been made in establishing new industries in South Wales. By the beginning of this year 96 factory building schemes, each of more than 5,000 sq. ft. of floor space, had been approved since January, 1945. These are mostly to be occupied by firms specialising in light industries. Sixty-six of these factory buildings are being financed by the Government; they will be run, however, by private firms. The remaining factories are being built and financed entirely by private firms. In addition, 13 Government wartime factories and six Government "standard" factories have been allocated to various firms for the production of civilian goods, while two of the larger Royal Ordnance factories are being converted into trading estates.

Of the six standard factories, each of 50,000 sq. ft., one at Ystradgynlais has been allocated to Smith's English Clocks, Limited; one at Blackwood to South Wales Switchgear, Limited; and one at Neath to the Midland Metal Spinning Company, Limited.

Below are details of some of the factory building schemes approved for the South Wales Development Area up to January 1, 1946, with the floor space entailed and the products it is proposed to manufacture:—

Cardiff: Alpha Bearings, Limited, 10,000 sq. ft., anti-friction metal bearings; Hopkinson's Motor & Electric Company, Limited, 120,000 sq. ft. (new), electric motors; Lewis & Tylor, Limited, 5,600 sq. ft. (extention), hose and machine belting; S.I. Holdings, Limited, 13,200 sq. ft., plating and anodising; Wyndham Engineering Company, Limited, 7,500 sq. ft. (new), prefabricated small building frameworks.

Cwmbran: Guest, Keen & Nettlefolds, Limited, 28,200 sq. ft., railway permanent-way iron castings (built).

Fforest Fach: C. H. Parsons, Limited, 50,000 sq. ft. (new), electric switches, etc.

Newport: Goulds Foundries, Limited, 5,000 sq. ft. (new and extensions), "Meehanite" high-duty jobbing castings; John Lysaght, Limited, 10,800 sq. ft. (extension), steel sheets; Santon, Limited, 89,000 sq. ft., electrical water-heating equipment and rotary switchgear; Whitehead Iron & Steel Company, Limited, 120,000 sq. ft., re-rolled iron and steel products (completed).

## CARBON STEEL BOILER PLATE

A method of test has been issued by the British Standards Institution for checking the creep quality of boiler plate steel. This test has been prepared after a considerable amount of research work on specimens of boiler plate, and the Standard lays down the conditions of the test and the values which should be regarded as satisfactory. Copies can be obtained from the British Standards Institution, 28, Victoria Street, London, S.W.1 (price 1s.).

THE "IRON AGE" states that a new development will use 30,000 tons of magnesium annually in the form of cathode production for steel pipelines. A magnesium anode buried in the ground is said to divert electrical action from the pipeline.

## RATE FIXING AND TIME STUDY

(*Continued from page* 178.)

*6.—Fettling.*

All steelwork and heavy ironwork paid on tonnage for each operation.

*7.—Fettling.*

Small iron castings are rated as straight piecework.

*8.—Labourers and General Workers.*

These are grouped and paid on tonnage.

All scrap castings due to bad work are not paid for. This is checked by the foreman in charge of the department. It is not claimed that these wage systems are all that is desired, but they have helped to produce large quantities of castings during a very difficult period, and with an absolute minimum of labour troubles. Unfortunately, these methods, although getting good results, leave much to be desired As the old proverb says, "Don't put new wine in old bottles," so one cannot use modern ideas of time study successfully in old foundries with half-hearted attempts at mechanisation.

### Discussion

MR. CARRICK asked if Mr. Hardy would enlarge on his statement that for some jobs he set a basic output and paid a bonus of so much a mould on every mould over this basic number. He was particularly interested because his firm had a similar scheme for certain types of jobs where they paid a bonus over the day work fixed for these jobs.

MR. HARDY, in reply, said he found that in simplifying the method of moulding on semi-jobbing work by having standard box sizes on one machine and setting up work, etc., it was possible to group work on a machine so that the output per hour seldom varied, and the men could earn up to 45 per cent. above the day rate, and that wages did not fluctuate any more than 5 per cent. from week to week.

MR. C. H. KAIN, in supporting Mr. Hardy's remarks, said that it was found that this was the best method to get the men to realise that the more they make the better it was for all concerned, and by paying a bonus on, say, a 50-mould basis of 2d. between 50 and 60, 4d. between 60 and 70, and 6d. between 70 and 80, it was obvious that the greater the output the better for the men.

## CARBON PRODUCTS

The use of carbon and graphite in the iron and steel industry has increased considerably in recent years, and new applications are of interest. According to Frank Vosburgh, in an article in the "Iron and Steel Engineer," a new material, an impervious form of carbon or graphite, highly resistant to chemical attack and having unusual heat-transfer qualities, is being widely applied as heat exchangers for heating and cooling the most corrosive pickling solutions. The material is available also as pipe and fittings and is fabricated as valves and pumps.

## VANDERBIJL ENGINEERING CORPORATION

Iscor (South African Iron & Steel Industrial Corporation, Limited) took part last year in the formation of the Vanderbijl Engineering Corporation, and holds a substantial shareholding in it. This corporation, which has a registered capital of £2,000,000, and an initial issued capital of £1,200,000, has acquired a number of machine tools from Iscor; and the manufacture of spare parts, etc., for Iscor will form the base load on which the corporation's developments will be founded. The corporation will also undertake the manufacture of heavy engineering, industrial and mining plant and equipment of sizes and designs not hitherto manufactured in South Africa. In this connection the corporation has entered into arrangements with the Mesta Machine Company, of Pittsburgh, Pennsylvania, and with Ashmore, Benson, Pease & Company, Limited, of Stockton-on-Tees. Iscor is associated in this development with the Anglo-American Corporation of S.A., Limited, and a number of other mining companies, and also with a number of companies in the local engineering industry, with which the Vanderbijl Engineering Corporation's developments will be complementary.

## CONTROL OF FACTORY AND STORAGE PREMISES

The Board of Trade have made an Order (S.R. & O., No. 89) revoking as from January 31 the Location of Industry (Restriction) Order, 1945, under which a licence was required from the Board of Trade before use could be made of factory or storage premises having a total floor space of 3,000 sq. ft. or over. The revocation does not affect the Government's powers in regard to location of industry under the Distribution of Industry Act, 1945, nor does it in any way prejudice the control over the manufacture of particular classes of goods which exists under other Orders.

## VENTILATION AND DUST CONTROL IN FOUNDRIES

(*Continued from page* 179.)

perspire freely. Fumes and heat from core stoves could be removed through slotted hoods specially designed for each job on its particular merit.

In a mechanised foundry the ventilating problem was simplified, and could be dealt with at the knockout and the screen, where the greatest contamination occurred much more easily. Generally, in a mechanised foundry, if the control of the air was regulated at these two points, satisfactory ventilation could be obtained over the remainder of the foundry area by roof ventilation.

Summing up, therefore, foundries should be ventilated by positive means, the movement of air inward and outward being directed by mechanical plant. The ingoing air must be fairly clean, otherwise it would only add to the already dirty conditions, and it should be warmed to a reasonable degree so as to prevent unhealthy draughts, bearing in mind all the time that any air extracted must be replaced

## WELSH STRIP MILL PROJECTS

### PRELIMINARY WORK TO START

Richard Thomas & Baldwins, Limited, have decided not to wait for Government approval of schemes for the establishment of further strip mills in Wales, but to go ahead with the essential preliminary work. Part of these projects is the erection of two new cold reduction plants, which will be carried out by a new company to be formed by a group of existing companies headed by Richard Thomas & Baldwins, Limited.

In view of the magnitude and importance of these schemes, the board of the latter company have agreed that Mr. T. O. Lewis and Capt. H. Leighton Davies shall be loaned to the proposed new company for the purpose of supervising the erection of these two plants. In order that they may devote the whole of their time to this project they will give up for the time being their duties as general managers of the West Wales section of Richard Thomas & Baldwins, Limited. These duties will be taken over by Mr. Cecil F. Gilbertson and Mr. Charles G. Gilbertson.

To give effect to these rearrangements Mr. T. O. Lewis and Capt. H. Leighton Davies will be appointed directors of the new company when it has been registered, and Mr. T. O. Lewis will relinquish his directorship of Richard Thomas & Baldwins, Limited.

## NATIONAL EXHIBITION OF DESIGN

The Council of Industrial Design announces that the National Exhibition of Design will be held at the Victoria and Albert Museum and will be opened on September 24. The shortage of suitable building space in London in present conditions is such that, in view of the national importance of this project and at the special request of the Council, the Museum authorities are clearing a large portion of the building to make way for the Exhibition. Executive Committees have been set up by a number of industries to act in liaison with the Council, including the electricity, gas, solid fuels, domestic light, metalware, scientific instruments, cutlery, and hand and garden tools.

## PRICES OF ALUMINIUM FLUORIDE AND SILICON

The Minister of Supply and Aircraft Production announces that, as from January 1, 1946, the following price reductions became operative:—

Aluminium fluoride, from £85 per ton, delivered U.K., to £76.

Silicon (metallic not less than 97 per cent. content), from £85 per ton, delivered U.K., for lots of less than 30 tons, and £82 10s. for 30-ton lots and over, to £67 10s. and £65 respectively.

MR. C. J. LAKE AND MR. C. H. KAIN have been appointed joint managing directors of Lake & Elliot, Limited, engineers and founders, of Albion Works, Braintree, Essex. The appointment of Mr. G. Clement Jenks as chairman was announced recently

## NEWS IN BRIEF

THE BARROW HEMATITE STEEL COMPANY, LIMITED, contemplates entering the field of cement production.

THE BRISTOL OFFICE of the British Aluminium Company, Limited, has been removed to 62, Queen Square, Bristol, 1.

EDGAR ALLEN & COMPANY (SOUTH AFRICA), LIMITED, have changed their office address to 508/514, Garlick House, Harrison Street, Johannesburg.

THE WELSH INDUSTRIES FAIR, an annual event before the war, will be held at Cardiff from May 27 to June 1, organised by the National Industrial Development Council of Wales and Monmouthshire.

THE U.S. STEEL CORPORATION has declared that it would need a price increase "greatly in excess of 31s. 3d. a ton" if it granted the 11d. an hour pay rise recommended by President Truman and accepted by the 800,000 strikers.

BURNTISLAND SHIPBUILDING COMPANY, LIMITED, have secured a contract to build a 3,500-ton cargo liner for the Prince Line, London. The company has also signed a contract with Imperial Chemical Industries, Limited, to build a Diesel-engined coastal vessel of 640 tons deadweight.

THE COUNCIL OF DUNDEE UNIVERSITY COLLEGE has received a gift of £100 from Urquhart Lindsay & Robertson Orchar, Limited, foundry owners, etc., of Dundee, and £20 from the chairman and board of the firm, to help meet the cost of the X-ray apparatus installed in the department of physics.

AVELING-BARFORD, LIMITED, manufacturers of road rollers and other power-driven plant, are issuing £75,000 of new 5½ per cent. cumulative preference shares of £1 each and £125,000 of new 5s. ordinary shares. This will increase the preference capital to £250,000 and the ordinary capital to £375,000.

JARROW CORPORATION has approached the New Jarrow Steel Company, Limited, regarding work prospects. The firm stated that they had no immediate expansion schemes in prospect, but they had production plans which would depend upon other industries coming into the area which could use their products.

THE PARTNERSHIP between Mr. Henry Greenwood and Mr. Arthur Rhodes, carrying on a business of engineers, sheet-metal workers, etc., under the name of Arthur Rhodes & Company, at Beck Street, Greengates, Keighley, has been dissolved. All debts will be settled by Mr. Rhodes, who will carry on the business.

JOHNSON & PHILLIPS, LIMITED, electrical engineers and cable makers, of Charlton, London, S.E.7, have acquired the business of British National Electrics, Limited, of Newarthill, Lanarkshire. It is intended to operate and develop the latter works to provide increased facilities for the manufacture of electric water heaters, cookers and other domestic appliances.

WHAT ARE BELIEVED to be the largest diameter seamless, austenitic stainless steel tubes yet produced by the piercing and drawing process have just been completed by Tube Investments, Limited, at Chesterfield, for the food industry. The tubes are 14 in. outside dia., ¼ in. thick and over 20 ft. in length. They are to be used in a food plant and will be subject to severe high-frequency vibrations.

THE CLAIM of the unions in the engineering industry for an increase in the basic wage of 20s., and corresponding advances to piece-rate workers, for a five-day week of 40 hours, a fortnight's annual holiday with pay, and payment also for six statutory or customary holidays each year, was presented to the employers last week. At the same time the unions asked that the guaranteed week, which has been enforceable under the Essential Work Order, should be embodied in the agreement between the employers and the unions.

VALUABLE ASSISTANCE has been rendered to local electricity and gas companies by the Ford Motor Company, Limited, Dagenham, during the period of fuel shortage. Supplies of electricity in some districts, early last year, had to be cut, and the Ford management offered their assistance to maintain output. The Central Electricity Board welcomed the idea and asked whether the Ford factory could undertake to supply 7,000 kilowatts per hour for distribution on the grid system. This was agreed and the arrangement came into force the next day. During the present winter, daily supplies have been increased and reached 20,000 kilowatts per hour at peak periods. The Ford organisation has for many years been able to supply gas, superfluous to its own requirements, to the Beckton Gasworks by means of a direct pipeline carrying an average daily supply of 2,000,000 cub. ft. In addition, the company provide Beckton daily with 150 tons of domestic coke.

## BOOK REVIEW

**The Law of Trade Unions,** by H. Samuels, M.A., Barrister-at-Law. Published by Stevens & Sons, Limited, 119 and 120, Chancery Lane, London, E.C.2.

Mr. Samuels stresses in his preface that the "activities of trade unions in relation to the implications of the law of conspiracy have in the past been a fruitful source of litigation." Thus it can be presumed to mean that the legal profession has had a good "rake off" in the past—a factor which has not escaped the notice of the reviewer. Thus this little book is opportune, as herein is set out in 12 chapters the present state of the law in so far as it affects the conduct and rights of organised labour.

The chapter most likely to be studied at the moment is number nine, which covers the "Political Fund." It is an extremely simple matter to understand, but so far as the layman is concerned some of the others are not so lucid, but no doubt are really crystal clear to those versed in the law. Thus we found chapter 3 somewhat "hard going." Yet compared with the average legal tone the author has certainly made the reading matter as simple as possible. For those interested in either his rights under trade union law or those whose duty it is to control their activities, this book should be invaluable. V. C. F.

# THE MODERN PIG

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**IF YOU WANT...**
***clean iron, free from sand, free from sows ...uniform analysis... convenient size...easy handling... specify STANTON MACHINE CAST PIG IRON***

SPECIFICATION

| | |
|---|---|
| WEIGHT | 80-90 lbs. |
| Length | 22 inches |
| Width | 8½ inches |
| Thickness | 3¾ inches |

(at notch 2½ inches).

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**STANTON, HOLWELL & RIXONS BRANDS**

**THE STANTON IRONWORKS COMPANY LIMITED NEAR NOTTINGHAM**

## PERSONAL

MR. W. JENKINS GIBSON has been appointed a director of Hadfields, Limited, Sheffield.

MR. H. C. STREET has been appointed managing director of Vivian Younger & Bond, Limited, metal merchants.

MR. T. W. COLVIN has been elected assistant general secretary of the National Union of Foundry Workers. He took up office on January 6.

MR. F. R. CUMBERLEGE has been appointed to the board of Bratt Colbran, Limited, engineers and iron-founders, of Wembley, Middlesex.

MR. A. S. JOHNSTON, MR. A. LINDSAY and MR. W. M. SERVICE have been appointed special directors of William Beardmore & Company, Limited.

SIR JAMES LITHGOW has relinquished the post of Controller of Merchant Shipbuilding and Repairs at the Admiralty, which he has held since its creation six years ago. The post will now lapse.

MR. N. J. SANDERS has retired from the post of London District Organiser of the National Union of Foundry Workers, owing to ill health. His duties have been taken over by MR. G. COLLINS.

MR. GEORGE PARKIN is leaving Sheffield shortly to become chief metallurgist to J. B. & S. Lees, Limited, West Bromwich. He has had many years' experience with Spear & Jackson, Limited, and other companies.

MR. H. O. GUEST, assistant engineer with the Consett Iron Company, Limited, has been appointed chief maintenance engineer with Hadfields, Limited, Sheffield, and has received a presentation from his Consett colleagues.

MR. W. H. HIGGINBOTHAM, chairman of Edgar Allen & Company, Limited, Sheffield, has been elected a member of the first committee to carry on the Sheffield Group of the Industrial Applications Section of the Royal Statistical Society.

MR. C. E. LINTON, who joined the staff of Hadfields, Limited, Sheffield, 48 years ago, has retired. He was one of the first office managers of the tramway track department, and afterwards became confidential private secretary to successive directors.

MR. L. W. SMITH has retired from the position of managing director of Elliott Bros. (London), Limited. He is succeeded by MR. G. K. R. LEE, who also becomes a member of the Council of the British Electrical and Allied Manufacturers' Association.

MR. WILLIAM J. WIGNEY has, on being appointed vice-chairman of Andrews Toledo, Limited, relinquished his position as managing director. MR. MALCOLM BROWN has been appointed managing director of Andrews Toledo, Limited, and of the Wardsend Steel Company, Limited.

MR. R. M. PARRY, sales manager of Henry Wiggin & Company, Limited, has been appointed sales assistant to the managing director of the Mond Nickel Company, Limited. MR. R. E. ANSELL, formerly technical service manager, becomes sales manager of Henry Wiggin & Company.

MR. T. A. IRVINE, JUNR., D.S.O., has been released from active service and is now a partner in the firm of Irvine Bros., iron and steel merchants, Bothwell Street, Glasgow. Mr. Irvine gained the immediate award in the field of the D.S.O. while commanding a battalion of the Worcestershire Regiment in Burma last year.

MR. STANLEY J. HARLEY has been released from his position as Technical Controller in the Machine Tool Control, Ministry of Supply. Although Mr. Harley will no longer have executive responsibility in the Machine Tool Control he has consented to remain as Chief Technical Adviser to the Director General for a further period.

MR. J. T. PEARSON, buyer and production manager with C. A. Parsons & Company, Limited, Newcastle-upon-Tyne, has retired, and has received a presentation from the staff. Mr. Pearson started as an apprentice and in 1912 was put in charge of all production work. Afterwards he was made responsible for buying all material.

LIEUT.-COL. SIR HENRY K. STEPHENSON has decided, in view of the present changed circumstances in industry and in order to lighten his responsibilities, to retire from the position of chairman of the Sheepbridge Coal & Iron Company, Limited. He will retain his seat on the board. The board has elected LORD ABERCONWAY to succeed him as chairman.

MR. ALBERT CORKER, after spending 62 years in the service of the Midland Iron Company, Limited, has tendered his resignation as a director. His place on the board has been taken by MR. FRANK EASTWOOD, who has been associated with the company for the past 34 years. The directors have appointed the general manager, MR. ANTHONY J. WAINFORD, to be joint managing director.

MR. I. A. BAILEY, general manager of the Mond Nickel Company's refinery at Clydach, South Wales, since 1936, has been appointed managing director of Henry Wiggin & Company, Limited, a wholly-owned subsidiary. MR. J. O. HITCHCOCK, of the Nickel Company's development and research staff, has been appointed personal assistant to the managing director of Henry Wiggin.

SIR GRAHAM CUNNINGHAM has been released from his post as Chief Executive and Controller-General of Munitions Production in the Ministry of Supply. Sir Graham went to the Ministry of Supply in September, 1941, as Director-General of Production Services; he became Chief Executive and Controller-General of Munitions Production in 1942. In such capacity the research, development, production and inspection departments of the Ministry of Supply all came under his charge. Perhaps the most outstanding of his duties was his special responsibility for the production and development work undertaken by the Ministry in the preparation for D-Day.

### Wills

| | |
|---|---|
| WILSON, W. G., of Sheffield, ironfounder ... ... ... | £30,135 |
| FAIRBURN, C. E., chief mechanical and electrical engineer, L.M.S. Railway ... ... ... ... ... | £47,071 |
| GREENWOOD, T., of Guildford, a director of Greenwood & Batley, Limited, Leeds ... ... ... ... ... | £28,208 |

# WM CUMMING & CO., LTD.

**FOUNDRY PLANT**

The "CUMMING" PATENTED CRUCIBLE FURNACE

OIL-SAND MIXERS

ELECTRIC RIDDLES

MOULDING MACHINES

FOUNDRY FURNISHINGS

**FOUNDRY SUPPLIES**

CORE OILS

SEMI-SOLID K92 AEK

CREAMS CCC CIC

PARTING POWDERS XPP AND OTHER NON-SILICA GRADES

"STANDARD" "NEW GRADE"

*EX STOCK.*

KELVINVALE MILLS, MARYHILL, GLASGOW. N.W. AND BRANCHES.
AT FALKIRK, CHESTERFIELD, DEEPFIELDS AND MIDDLESBROUGH

FAR

## COMPANY RESULTS

*(Figures for previous year in brackets.)*

**Plessey Company**—Final ordinary dividend of 10%, making 20% (same).

**Steel Developments**—Profit for 1945, £4,583 (£4,567); dividend of 5½% (same); forward, £5,916 (£5,752).

**Brooke Tool Manufacturing**—Net profit for the year ended September 30 last, £38,617 (£33,626); dividend of 17½%.

**John Bolding & Sons**—Net profit for 1945, after allowing for taxation, depreciation, preference dividend, and staff bonus, £16,728 (£10,074); final dividend of 10%, making 14% (12%); forward, £39,078 (£31,850).

**David Brown & Sons (Huddersfield)**—Profit for the year ended September 30, £231,225 (£237,411); income tax, £94,660 (£121,781); contingencies, £75,000 (same); ordinary dividend of 10% (same); preference participation, 2½% (same); forward, £271,835 (£246,711).

**J. Samuel White & Company**—Trading profit for the year ended September 30, £62,903 (£58,623); net profit, £60,359 (£55,943); ordinary dividend of 6½%, tax free (same); to deferred repairs, £3,000 (same); to general reserve, £25,000 (same); forward, £22,085 (£12,126).

**Burnell & Company**—Net profit for 1945, after provision for depreciation and taxation and including some additional profits from previous year, £36,112 (£27,004); dividend of 15% (same) and a participating dividend of 1.568d. per share (same) on the 7½% participating preference shares.

## CONTRACTS OPEN

*Any date given is the latest on which tenders will be accepted. The address is that from which forms of tender may be obtained.*

**Hucknall,** February 25—Cast- or spun-iron pipes for one year, for the Urban District Council. The Surveyor, Council Offices, Hucknall, Notts.

**Oswaldtwistle,** February 18—Cast-iron pipes and special castings, for the Urban District Council. The Surveyor, Town Hall, Oswaldtwistle.

ON JANUARY 29, Lake & Elliot, Limited, engineers and founders, of Braintree, Essex, presented gold watches to four of their staff on completion of 50 years' service. The presentations took place in the works canteen in the presence of the directors, departmental heads and 180 of the employees whose service exceeded 25 years, 93 of whom had, in fact, more than 30 years' service. Mr. E. F. Elliot, who in 1896 went into partnership with the late Mr. W. B. Lake, founder of the business, handed the watches to Mr. F. W. Rayner, secretary of the company, Mr. E. A. Clarke, of the sales department, and Mr. Percy Gentry, of the the tool room. Mr. G. Clement Jenks, the new chairman of the company, then presented Mr. Elliot with a gold watch to commemorate his own 50 years of service to the company.

## NEW TRADE MARKS

*The following applications to register trade marks appear in the "Trade Marks Journal":—*

"SENTINEL"—Metal building components. SENTINEL (SHREWSBURY), LIMITED, Shrewsbury.

"RAD-VEC"—Fire grates. ANSON ACCUMULATORS, LIMITED, 29A, Comus Road, London, N.19.

"MUREX" and "MURIUM"—Common metals and alloys. MUREX, LIMITED, Ferry Lane, Rainham, Essex.

"PLATYPUS"—Large agricultural implements, etc. ARTHUR CLIFFORD HOWARD, 9, Stewart Avenue, Upminster, Essex.

"CROCODILE"—Welding apparatus, etc. INTERNATIONAL WELDING COMPANY, LIMITED, 2, South Parade, Bedford Park Avenue, London, W.4.

LEAPING ANIMAL (DEVICE)—Ingots of common metal or common metal alloys. E. HIND (SOUTHBANK), LIMITED, Imperial Works, South Bank, Middlesbrough, Yorks.

## BRITISH STEEL HOUSES

British Steel Houses, Limited, has been registered as a company limited by guarantee without share capital "to co-ordinate the interests and activities of members" in the provision, manufacture and erection of steel buildings, etc. The registered office is at Steel House, Tothill Street, London, S.W.1, and the Committee members include the Earl of Dudley (British Iron & Steel Corporation, Limited), and directors of Pauling & Company, Limited, Henry Boot & Sons, Limited, Bovis Public Works, Limited, Darlington & Simpson Rolling Mills, Limited, Dorman, Long & Company, Limited, John Summers & Sons, Limited, and Richard Costain, Limited.

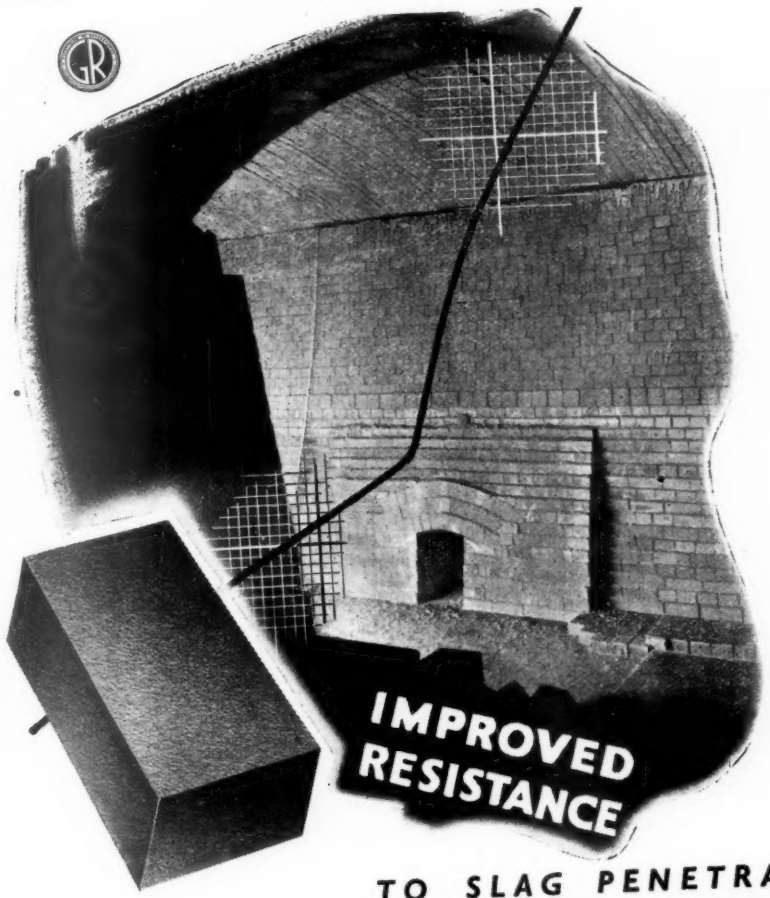
## SCIENTIFIC FILM ASSOCIATION

Speaking at the recent annual meeting of the Scientific Film Association, held in the theatre of the British Council, Mr. Arthur Elton, the president, suggested that future development lay along two lines. In the first place, the Association served as a means of bringing together the makers of films and their users—the teachers, the educators and social workers of all kinds. In the second place, the full international use of the film, as a means of informing all the peoples of the world about their neighbours and the doings of their neighbours, was one which held promise of the growth of a healthy spirit of internationalism.

## OBITUARY

MR. HARRY OWEN, a director of D. & H. Owen, Limited, Vulcan Foundry, Atherton, has died at the age of 76.

MR. THOMAS GLAZE, senior partner in the business of T. Glaze & Sons (Engineers), Limited, of Bloxwich Road North, Walsall, died recently at the age of 86. He was associated for many years with ironfounding, and had a foundry at Pelsall before he commenced business at Walsall.




## TO SLAG PENETRATION

SLAG penetration of refractory materials normally accompanied by erosion, surface spalling, shrinkage, etc., is frequently responsible for the ultimate failure of refractories. To reduce the destructive effect of slag penetration, volume-stable, dense, low-porosity, low-permeability bricks, with the correct chemical composition, must be used. A characteristic of G.R. products is that they possess these necessary qualities and thus ensure minimum slag penetration. The services of G.R. engineers are available on request, to users, on the choice and application of refractories.

FIREBRICKS · BASIC BRICKS
ACID-RESISTING MATERIALS
INSULATION · SILLIMANITE
AND HIGH ALUMINA BRICKS
SILICA BRICKS · PATCHING
AND RAMMING MATERIALS
REFRACTORY CEMENTS · SANDS

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## Raw Material Markets

### IRON AND STEEL

Whereas pig-iron production remains constant, consumption is on a rising scale. The widening of the gap between supply and demand is clearly foreseen, but apart from a blank refusal to license exports of pig-iron, nothing has yet been done to mitigate an impending stringency. Already a few consumers are complaining that their applications for licences have been pruned, and when the foundries get on to full production still more iron will be needed. There are many idle blast furnaces, and the provision of additional tonnages of iron ore and limestone would not be an insuperable difficulty. But the shortages of labour and of fuel are more retractable problems which discourage facile optimism. All that can be said at the moment is that production of light castings has not been impeded by inadequate deliveries of high-phosphorus iron, and although there has been some expansion in the demand for the special grades required in the engineering and jobbing foundries, the extra tonnages are being promptly provided.

Although the production of sheets has been raised to impressive proportions, makers are reasonably well provided with bars, and in this respect are certainly more favourably placed than the re-rollers of light sections, bars and strip. The clamour for prime steel billets is incessant, and it is evident that for a long time to come imports will have to be continued on a substantial scale to supplement home production.

Not even when war requirements were at their peak have the plate and section mills been so heavily engaged. Substantial tonnages are required for home use, and the offers of export business are far in excess of the capacity of the makers to supply. Delivery dates three or four months ahead are commonly indicated for heavy sizes, and the light mills have even more extensive commitments. The capacity of the sheet mills, though far in excess of pre-war figures, is unequal to the task of meeting all the heavy demands, and many of the makers are now refusing orders. The rail mills, too, have all the orders they can cope with for some months to come.

### NON-FERROUS METALS

The lead situation all over the world shows no signs of easing. In this country supplies continue to be extremely tight, thus causing consumers considerable anxiety. America also has an extremely difficult supply position, and the total stocks of the metal held in the United States is expected to be down to 40,000 tons at the end of the first quarter of this year.

Consumers of zinc in this country are finding supplies rather difficult to obtain, despite the fact that there is no real shortage of that metal here.

The copper position, generally, has shown no signs of clearing. Most buyers find supplies more difficult to get. It is reported from America that, despite the strike wave, and other labour difficulties, consumption of copper is maintained at a reasonable level. There is no fresh development in the position whereby Empire producers are endeavouring to obtain a better quotation on the British home market. At the same time it is reported that copper is being sold on the Continent at higher levels than the maximum price in this country.

### EMPLOYMENT OF SUBSTITUTE LABOUR

An agreement has been made between the National Light Castings Ironfounders' Federation and the Joint Committee of Light Metal Trades Unions, on the employment of substitute labour, the major provisions of which are:—

(1) That in order to expedite foundry output workers other than those normally engaged for foundry work shall be allowed to work in foundries.

(2) That during the period of relaxation, the position of skilled foundry workers in regard to the continuance of their employment shall not be prejudiced by the employment of substitute labour, and if suitable foundry workers are available they shall have first consideration.

(3) That the appropriate skilled foundry workers' base rates shall be paid to men who replace skilled foundry workers and carry out skilled work customarily done by them, either loose pattern or plate work.

(4) That appropriate semi-skilled rates shall be paid to men who assist on skilled work in a semi-skilled capacity.

(5) That the rates paid to women substitutes shall be in accordance with the arrangements come to regarding the light-castings industry as a whole.

(6) That this agreement shall not affect the rights of federated firms in regard to customs already existing or agreed upon, either locally or in individual shops, nor shall it affect change of method which is recognised as normal development in foundry practice.

(7) That parties are in principle agreed that a man employed on a class of work generally catered for and regulated by the craft unions should belong to one of the craft unions appropriate to the class of work on which he is employed. This agreement in principle covers not only existing classified employees but also new employees, including labourers, whose category may be changed by upgrading.

### ELECTROLYTIC MANGANESE IN STEEL

Seeking ways to make the United States less dependent upon foreign sources of manganese, the Bureau of Mines, it is stated, recently completed successful co-operative tests with industry on the use of electrolytic manganese from low-grade domestic ores in the manufacture of acid steel. Electrolytic manganese produced in a Bureau pilot plant and substituted for the usual imported ferro-manganese in full-scale commercial heats of steel at the co-operating plants proved entirely satisfactory.